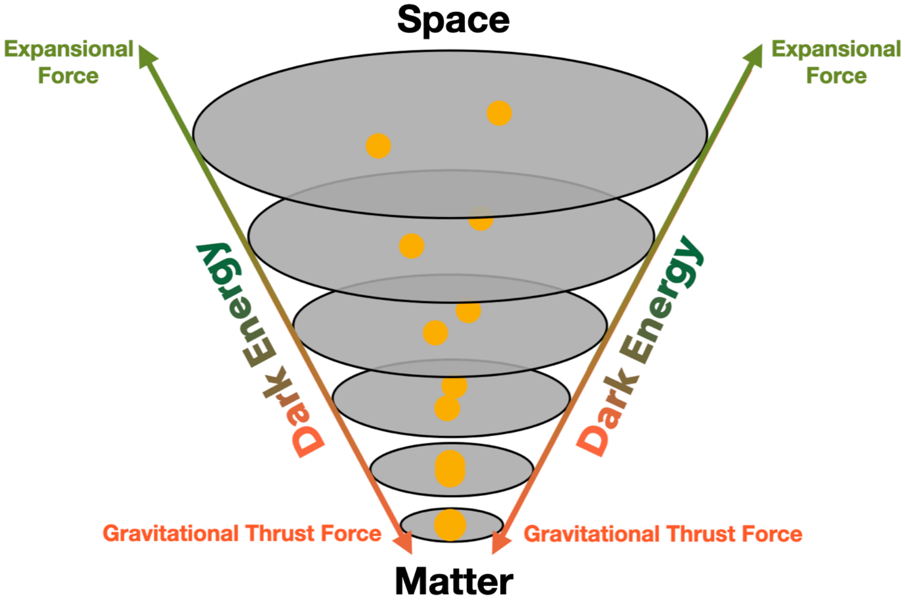
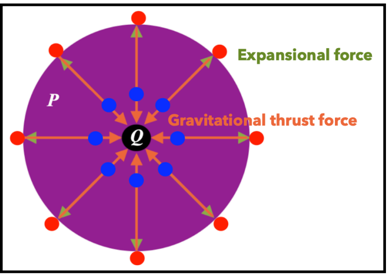
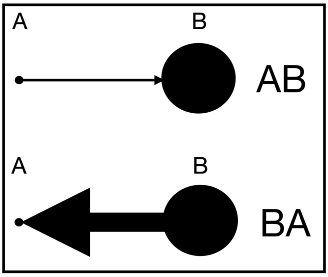
Before the Big Bang, Dark Energy,
Quantum Gravity and Singularities

The Theory of Space-Matter

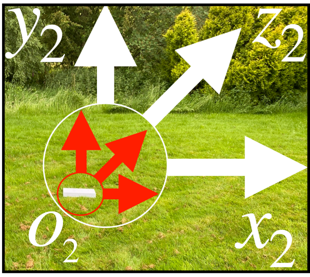




Gravitational Thrust



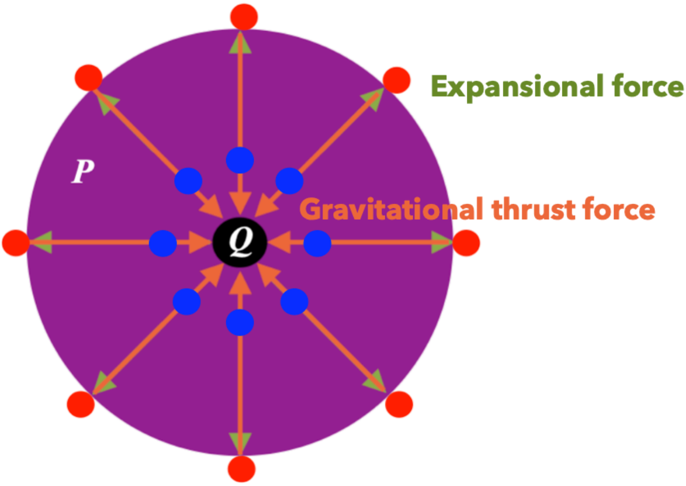
Relative Displacement



Infinite Dimensions

By India Soale

Before the Big Bang, Dark Energy, Quantum Gravity and Singularities



The Theory of Gravitational Thrust,
Relative Displacement,
and
Infinite Dimensions

By India Soale

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This paper is dedicated to William Charles Soale (1907 — 1961)

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Introduction to The Theory of Space-Matter

The **Theory of Space-Matter** consists of three sub-theories:

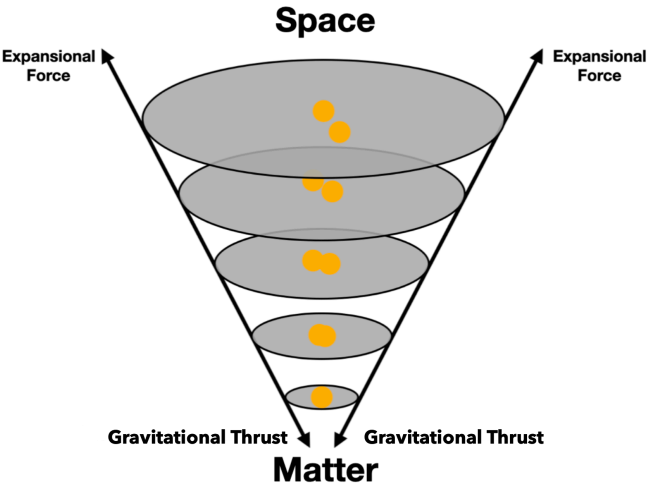
The Theory of Infinite Dimensions, *The Theory of Relative Displacement* and *The Theory of Gravitational Thrust*. These theories revolve around the concept of *space* and *matter* as the two fundamental properties of the universe.

Space concerns all expansions, fissions, divisions, repelling particles, replications, and reproductions.

Matter, on the other hand, concerns all gravitations, fusions, masses, attractions and collisions. And together, they form the inseparable relationship of **space-matter**.

Gravity, is the force of matter, and is a reaction (thrust) force to the **expansion** of space, an action force.

Expansion, is the force of space, and exerts gravitational thrust in the opposite direction. The interdependent relationship of space and matter are illustrated by the space-matter graph below, which will be explored in the third chapter.



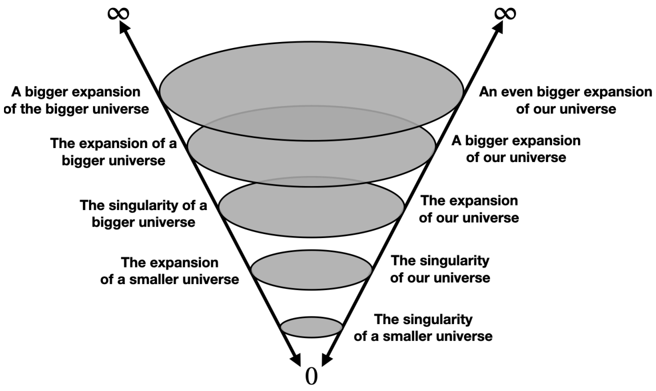
In addition to the three theories, each chapter aims to establish several key observations.

Firstly, that the beginning of the universe infinitely tends towards zero — it does not have a universal beginning or ultimate singularity point. Rather, it has a beginning or ending relative to the size of the matter in question.

The Theory of Relative Displacement aims to establish that space is proportional to one's size. That is to say, what may be a large space for a human is not a large space for a planet, and what may be a large space for a planet is not a large space for a galaxy, and so on.

For significant proportions of our universe, The Big Bang has barely begun. For matter significantly smaller than ourselves, the universe has expanded more proportionally to that matter than to us — the universe for the astronomically small is far larger than the universe proportional to us.

The universe, therefore exists on a continuous spectrum between a singularity and an expanded state — its beginning, duration and end are all fundamentally one. If we suppose that every disc in the diagram below is an iteration of the universe's expansion, the smaller discs are singularities relative to the larger discs and the larger discs are expanded states relative to the smaller discs.


∞
∞
A bigger expansion of the bigger universe
An even bigger expansion of our universe
The expansion of a bigger universe
A bigger expansion of our universe
The singularity of a bigger universe
The expansion of our universe
The expansion of a smaller universe
The singularity of our universe
The singularity of a smaller universe
0

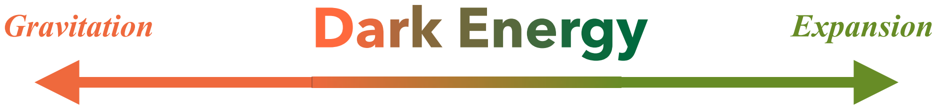
Secondly, that dark energy is a double-arrowed force in which one end of the force (gravity) repels the other end of the force (expansion).

In this paper, the force which resists gravity is referred to as *expansion* or *expansional force* and it constitutes as any force which resists a gravitational pull.

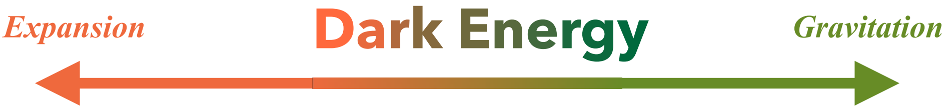
The gravitational pull of a celestial body such as Earth, repels the expansion of the universe.

For instance, if you fall towards the Earth, then you follow the gravitational end of the force relative to Earth. If you resist the Earth's gravity, then you are travelling towards the expansional end of the force relative to Earth.

The further you travel out into the universe, the more gravity you resist and the closer you get to the expansion end of the force.

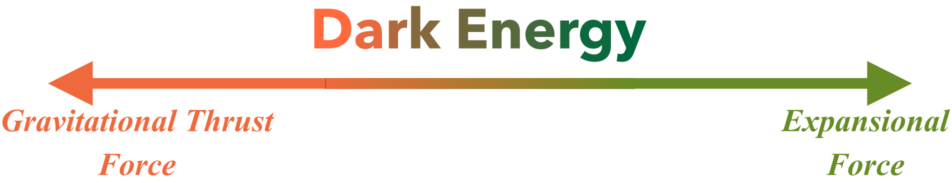


However, as you resist the gravitational end of the force and approach the expansional end of the force, the roles of the two sides reverse. The direction of the expansional force becomes the gravitational end of the force and the gravitational end you resisted is now the expansional end of the force from your perspective. Therefore, what is expansion on one end is gravitation to the other end, and what is gravitation on one end is expansion to the other end.



Throughout this paper, the *gravitation* end of *dark energy* is referred to as *gravitational thrust force.* The *expansion* end of *dark energy* is referred to as *expansional force*.

Expansional forces create space, whereas *gravitational thrust forces* create matter. The interdependencies of *expansional force* and *gravitational thrust force* manifest as all things in the universe, which will be explored in the third chapter.



Thirdly, that the expansion of the universe exerts gravity in the opposite direction to the expansion.

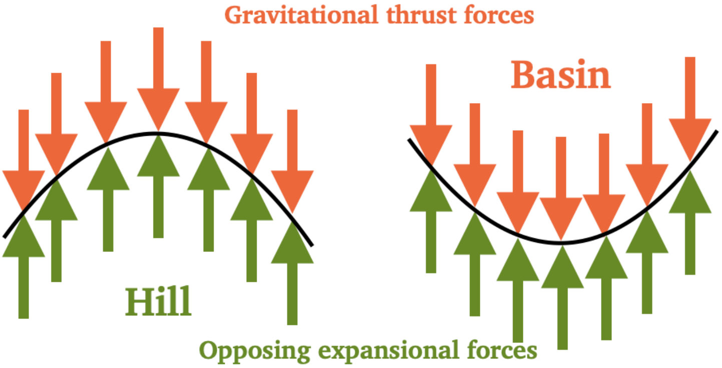
These gravitational forces bring matter closer together, forming all non-space which we observe in the universe.

Gravity is a pushing force for the expansion of the universe where the expansion of the universe is the pushback. Those closest towards the pushing end fall under the influence of gravity, whereas galaxies and galaxy clusters closer towards the pushback end are observed to be moving away rather than towards.

However, from the perspective of the galaxies moving away from us, we are observed to be the ones moving away from them. And these galaxies fall under the influence of gravity on their end of the expansion. The expansion of the universe is therefore also a reaction force, where gravity is the action force.

Fourthly, that gravitation and expansion on all scales behave as electromagnetic forces which create all matter and space.

All curvature is formed by the attractions or collisions of gravitational thrusts and the opposing expansional forces.



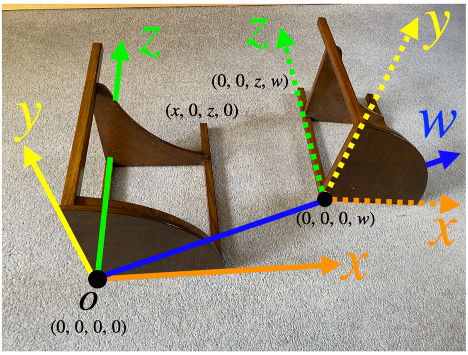
When gravitational thrust forces clash with expansional forces, they form matter. When gravitational thrust forces and expansional forces repel, they form space. These two key observations will also be explored in the third chapter.

Fifthly, that just as space is proportional to the size of matter, the dimensions of space or matter are proportional to the larger space which they are apart of.

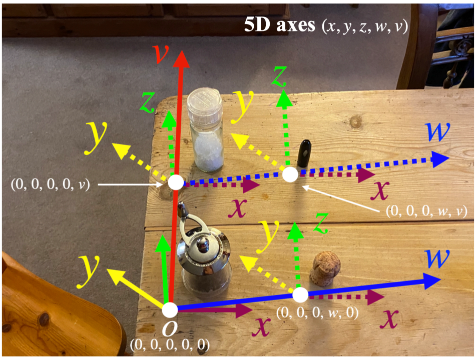
This brings me onto the first part of *The Theory of Space-Matter*: *The Theory of Infinite Dimensions*.

The Theory of Infinite Dimensions, is in simple terms, the concept that the third spatial dimension is a generalisation for all spatial dimensions between 2 and infinity rather than one concrete dimension. Furthermore, that larger objects or spaces have greater spatial dimensions than smaller objects or spaces.

The first chapter establishes that the displacement between two '3D' objects is not 'inside the third dimension', but rather a 'fourth spatial dimension.' This concept is then repeated to demonstrate a fifth spatial dimension, and can be repeated for a sixth, a seventh, and so on.



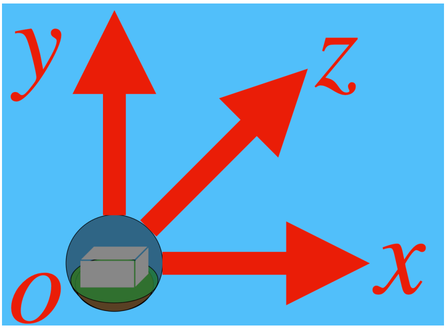
4D axes (x, y, z, w)

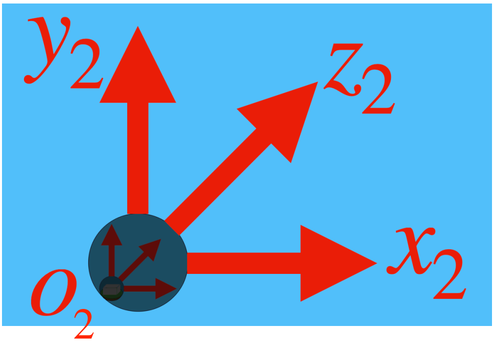


5D axes (x, y, z, w, v)

The next part demonstrates a simpler approach to realising dimensions beyond three. In short, all bodies, objects or spaces can be contained inside of a sphere. The sphere behaves as an origin point relative to the dimensions outside of it. That origin point and the dimensions outside of it can then be placed inside of another origin point in which further dimensions extend out of, and so on.

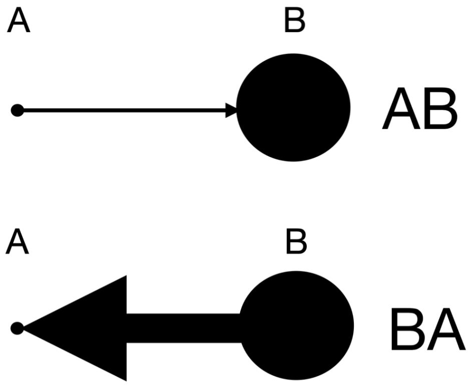
This notion is explored in great detail in the first chapter and the third chapter, where the concept of *relative zeroes* is first introduced to explain the nature of singularities.





The second part, *The Theory of Relative Displacement* is the concept that distance is proportional to the size of the body in question.

In the image below, the distance between the two differently-sized points A and B is the same. Yet it is longer proportional to A than to B. Equally, the distance between A and B is shorter proportional to B than to A.

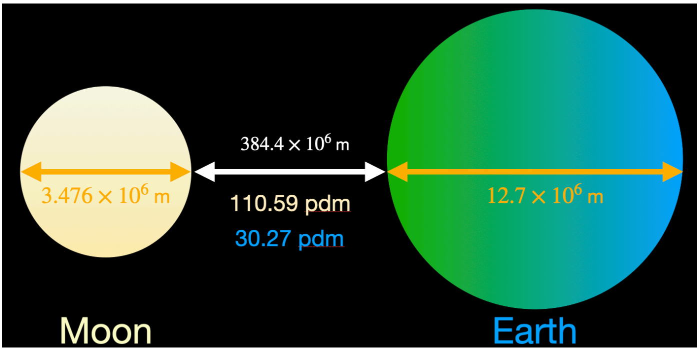


The same would be true if we measured our distance from an ant a metre away from us. The 1 metre distance experienced by the ant would be many times the ant's body length. Therefore, using the same measurement of distance for both our self and the ant would not tell us anything about the disparity of the situation. We could convert the distance to a smaller unit of measurement for the ant, but this would not tell us anything about the displacement experienced by the ant specifically, or for insects of a different size.

The Theory of Relative Displacement aims *to* solve this problem by measuring distance not in terms of a universal measurement for all, but in terms of a measurement proportional to the size of the body in question.

Relative displacement is calculated by dividing the displacement by the body's parallel diameter (the diameter of the body which is inline with the displacement). It tells you how many of that body's diameter fit inside a universal measure of displacement. Relative displacement is then measured again on the other end of the displacement for the other body. The relative displacements of each of the two bodies for that displacement are then compared, illustrating the effect of one's size on the space which they are apart of. Relative displacement is therefore measured in parallel diameters (pdm) for all bodies.

In the example below, displacement between the Moon and the Earth, and their respective diameters parallel to the displacement are measured or estimated in metres. The displacement is then divided by the diameter for each of the two bodies, generating a relative displacement for the Earth ($30.27\ pdm$) and another for the Moon ($110.59\ pdm$). This exercise is explained in much greater detail in the second chapter.

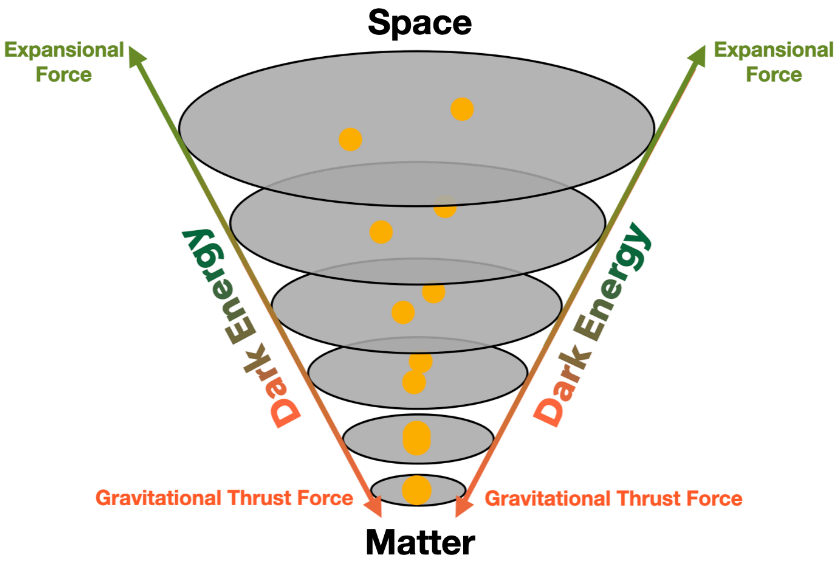


The principle of *relative displacement* is then extended to motion where a body's motion is described in terms of how many of its own parallel diameter it has travelled per second ($pdms^{-1}$).

The third part, *The Theory of Gravitational Thrust,* goes into much greater detail on the concepts I first introduced at the beginning of this introduction. That in order for the universe to expand, it must create a force in the opposite direction, which we experience as gravity.

The chapter explores the beginning, duration and end of our universe in greater detail. It also introduces the concept of relative zeroes, the electromagnetic nature of gravitational thrust and expansional force, and their roles in the formation of all matter and space.

Though it may be tempting to skip ahead to the third chapter, I strongly recommend reading from the beginning, as the foundations are laid in Chapters 1 and 2.

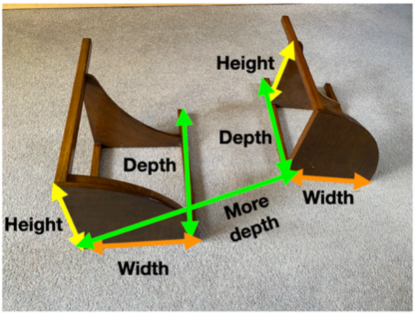


1 — Introduction to Further Spatial Dimensions

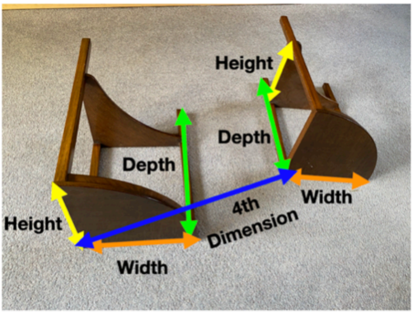
For centuries we have become accustomed to what I refer to as *The 3D Generalisation* — the idea that everything we see or everything around us is limited to three dimensions, and that anything beyond three is beyond us, which evidently below, is not the case.

A point is said to have *zero dimensions* and a line is said to have *one dimension*, as the line connects two *zero-dimensional points*. A square is said to have *two dimensions*, as its second dimension (height) connects two *one-dimensional lines* (width). A cube is said to have *three dimensions*, as its third dimension (depth) connects two *two-dimensional squares*.

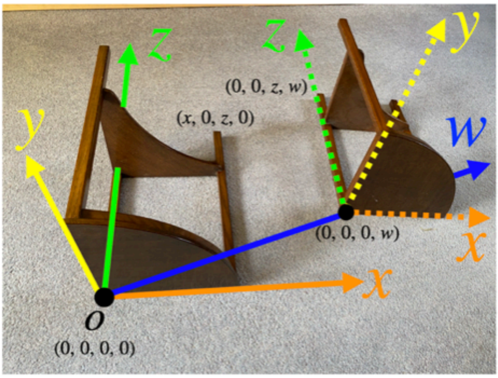
It should logically follow therefore, that an object or space which connects two *three-dimensional* objects or spaces by a length , is a *four-dimensional* object or space. Or more generally, a space is said to have *n dimensions* if it connects two $n - 1$ *dimensional spaces*. As shown below, the distance between the two '3D' drink tables is not inside the *third dimension,* but is a *fourth spatial dimension*, which connects two *three-dimensional* tables to form one *four-dimensional* space. As one will discover later on, even '3D' spaces like the drink tables individually below are not merely '3D.'



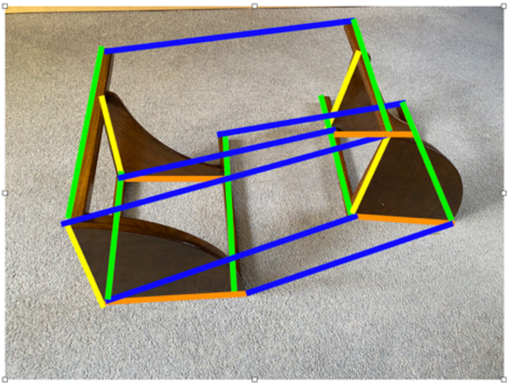
The 3D Generalisation



Reality



4D axes (x, y, z, w)



4D Shape

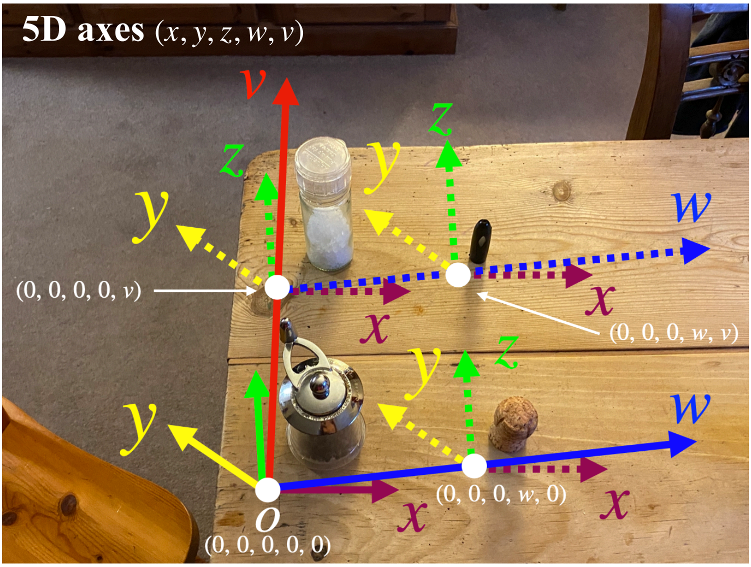
The 4D shape on the top right, which consists of the two drink tables and the space between them, can be displayed on a 4D set of axes, where width, height, depth and the space between the tables are represented by the variables x, y, z and w respectively.

In both the photos above, the lines of the same colour are all parallel to each other in reality, but because of lens distortion, they appear as if they do not look parallel.

If one were there in the room for their self, the drink tables would both appear to be parallel to each other in the fourth dimension, w, and the ‘3’ dimensions (x, y and z) of one drink table would be parallel to the ‘3’ dimensions (x, y and z) of the other drink table. The same applies for any scenario involving two ‘3D’ objects being placed on a relatively flat surface.

Visualising a fifth dimension is the same process as visualising a fourth dimension — the space between two 4D objects is not inside the fourth dimension but is a fifth spatial dimension. The picture on the following page shows five spatial dimensions in the real world. All four objects exist within their own individual ‘3D’ spaces.

In the image below, the pepper, the cork and the space between them make a 4D space. The salt and the pen lid also make a 4D space together. Both of these 4D spaces are separated by a fifth spatial dimension, denoted *v*.



Equally, salt and pepper both make a 4D space in the *v*-axis, as does the pen lid and the cork. From that perspective, the fifth spatial dimension would be in the *w*-axis and the fourth dimension would be in the *v*-axis.

If we observe the origin point, *O*, as if it were a much larger point containing all “three’ spatial dimensions of pepper — that is to say that if the respective *x*,*y*,,*z* axes encapsulating pepper were inside the origin point itself, then cork is a distance *w* away from pepper in the *w*-axis, whereas pepper is at zero in both the *w*-axis and *v*-axis because pepper’s entire dimensions are at the origin of those axes. At the same time, salt is a distance *v* away from pepper in the *v*-axis. This concept on origin points becomes much clearer on the next page.

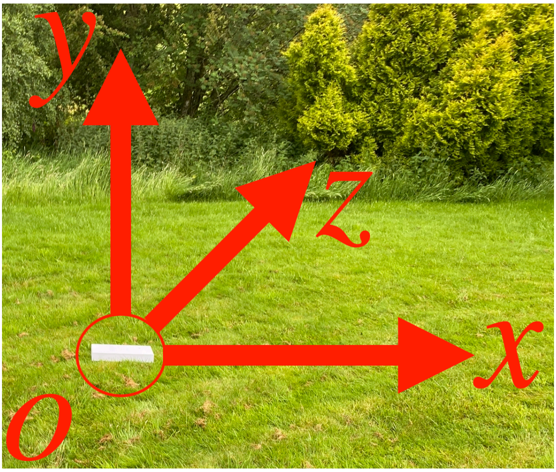
Here is an example of dimensions beyond three which may be much easier for most to conceptualise. The image below illustrates six spatial dimensions in the real world.

Contained within the origin point are the ‘three’ dimensions of a box — that is, the width, height and depth of the box. Part of this spherical origin point would obviously be underground and the part of the sphere encapsulating the box would be above ground. Alternatively, we can ignore the sphere altogether and simply treat the white box as the origin point. However, visualising the origin point as a sphere which contains the box is a more accurate approach for further on in this chapter.

One will notice that outside of this origin point there are another ‘three’ dimensions, x, y and z.

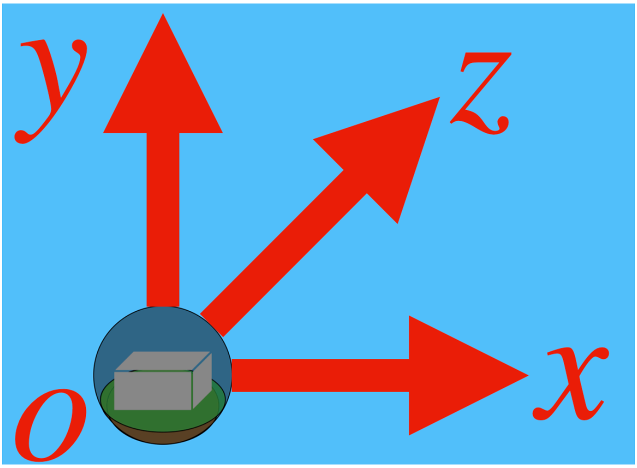
In this case, the x and z axes are on the ground, whereas y is above and below the ground.

If the box were to expand outside of the origin point which contains all of its dimensions, it would gain dimensions in the x, y and z axes. It would then not only have the ‘three’ dimensions of the origin point or any point of the same size, but an additional three dimensions in x, y and z.



If it were not expanded, but simply moved away from the origin point in the *x*-direction, it would still have its ‘three’ dimensions, but it would have been moved into a fourth spatial dimension, *x*. The same would occur if it were only moved in either the *y* or *z* directions.

If it were moved in both *x* and *y*, it would have been moved inside a fourth and fifth dimension. If it were moved in the *x*, *y* and *z* directions, then it would be moved inside a fourth, fifth and sixth dimension.

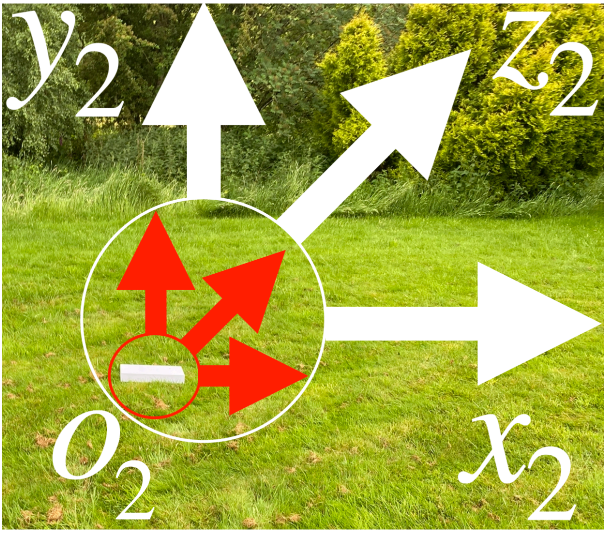


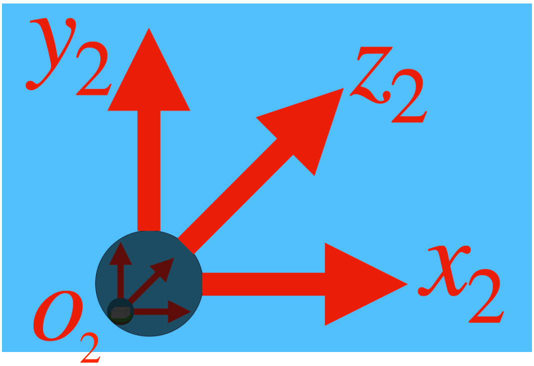
Another way of looking at the image above, is that the box has relatively no dimensions at all to the dimensions outside of it, as it has no lengths in *x*, *y* or *z*. Nor has the box moved in any of these axes. Relative to the box, however, it already has its three dimensions and will gain dimensions in *x*, *y* or *z* if a person were to approach the box and move it away from the origin.

Now model all six dimensions as the new origin point and draw another set of *x*, *y*, *z* axes outside of that origin point. We would then have nine spatial dimensions as shown on the following page.

In the images below, we have the dimensions of the box and the dimensions outside of the box contained within a larger origin point. This larger origin point is denoted O_2. By basing the ‘3’ dimensions of the box and the ‘3’ dimensions outside of the box as contained within the new origin point, O_2 , we can then conceptualise another ‘3’ set of axes branching out of O_2 , which are denoted x_2, y_2 and z_2.

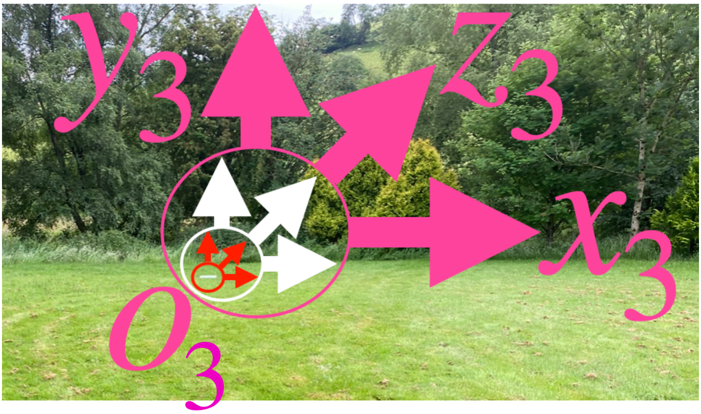
If the box is moved outside of the new origin point, it will start to move in the dimensions x_2, y_2 and z_2. The box can only fill an O-sized point. Therefore, at any fixed speed, it will take longer for the box to travel an equivalent distance of, say 2 metres, in x_2, y_2 or z_2 than the equivalent distance of 2 metres in x, y or z. This is because the dimensions of x_2, y_2 and z_2 are larger than x, y and z. Unless the box is moved outside of the new origin point, O_2, then it will not move in x_2, y_2 and z_2 at all. If the box grew outside of the new origin point, it would not only have the six dimensions illustrated in the previous example, but dimensions in x_2, y_2 and z_2.





If the box fit the size of the new origin point, O_2 , it would be equivalent to a point in the x_2, y_2 and z_2 axes. An equivalent distance of 2 metres travelled in x_2, y_2 or z_2 would translate to more metres travelled in x, y or z. This is analogous to the idea that if you measure any distance in metres, you would measure more metres than kilometres — what may be a large number in metres is a small number in kilometres.

The same process can be repeated to show 12 spatial dimensions. By modelling the 9 dimensions as the new origin point and drawing another set of x, y, z axes outside of that, denoted x_3, y_3 and z_3, we increase the number of spatial dimensions to 12.

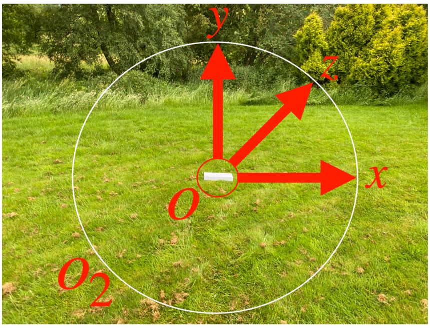


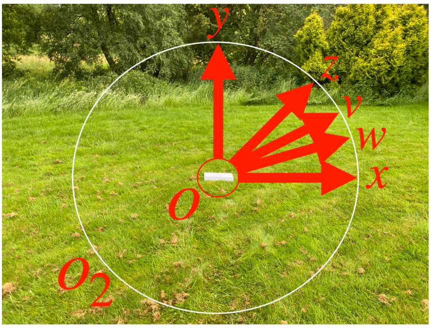
Every time the white box is to move in x_3, y_3 or z_3 it has to travel another point the size of the O_3.

The same process used to show 12 spatial dimensions, can be used to show 15 spatial dimensions, and so on. So far I have shown instances of increasing dimensions with a new set of x, y, z axes for each new origin point, but the increase in dimensions with each larger space is not limited to just increments of 3. Let us suppose that every possible line extending outside of an origin point is a dimension or axis.

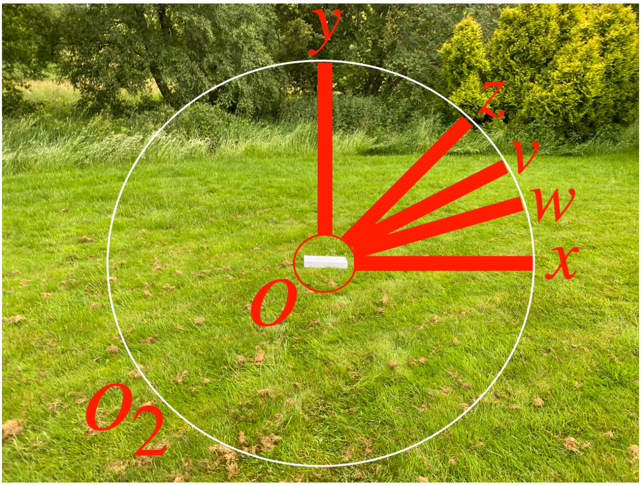
If we had infinite lines extending outside of a point or sphere, what shape would we get? A sphere. A '3D' sphere in the real world has infinite dimensions.

As shown in the bottom left image, one can conceptualise this by imagining a sphere encapsulating the white box or any other object and denoting that sphere as the 'origin point', O. One then imagines that sphere within another sphere, denoted 'origin point 2' or 'O_2'. In this case, O is the centre of the O_2 sphere. Now imagine every possible line joining O to O_2. There are infinite possible lines joining O to O_2 .And each and every one of them is a new axis or dimension. Every radius in the O_2 sphere is an axis or dimension. To begin with, let us imagine the x, y, z axes all acting as radiuses of the sphere, O_2 as shown in the bottom left image. Part of the O_2 sphere like O would obviously be underground. Now imagine, the other two axes we explored on page 12, w and v, also acting as radiuses of the sphere, O_2 as shown in the bottom right image.

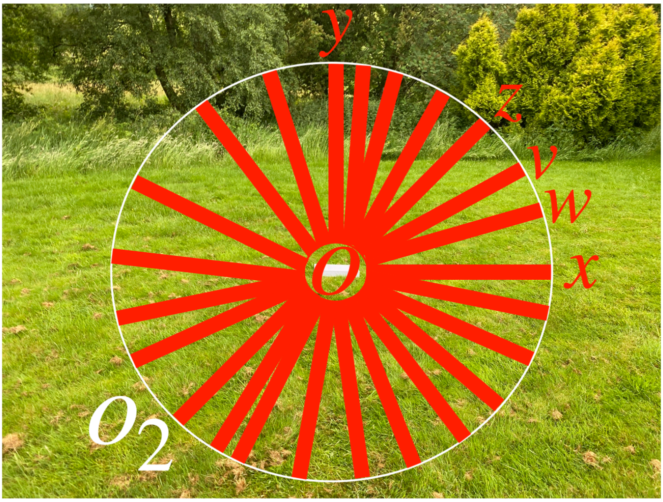




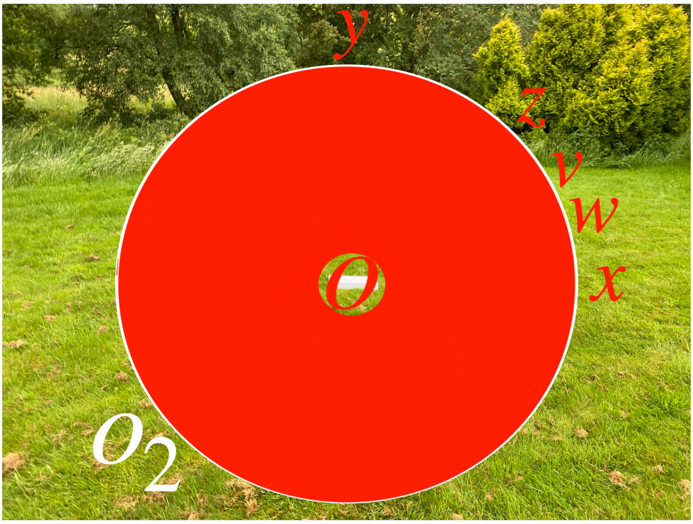
Every axis extending from O to O_2 is a line connecting O and the surface of O_2 together. All of the axes here behave as radiuses within the sphere.



Now imagine all of the other possible lines, or radiuses connecting the centre of O_2 to O_2 itself. Eventually, we will fill the inside of the O_2 sphere up with axes.



All of the space between O and O_2 is filled by infinite red lines where each and every red line is a dimension, and so one can see that O_2 has infinite dimensions.

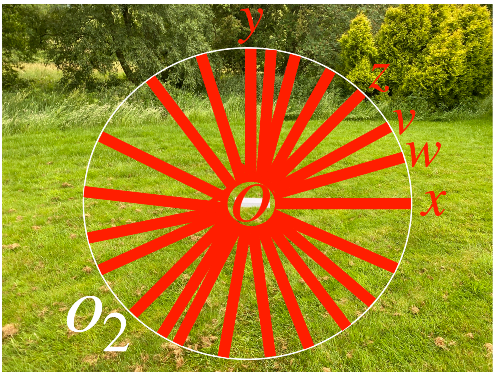


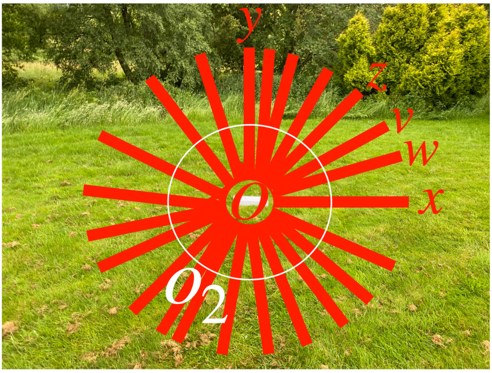
The sphere of space formed by the infinite axes is what I refer to as the ‘dimensional density’ or ‘dimensity.’

In the image above, the space between O_2 and its centre, O is occupied by infinite red lines or radiuses. Therefore, there are infinite dimensions in the space between O and O_2, and therefore there is infinite dimensity in that space.

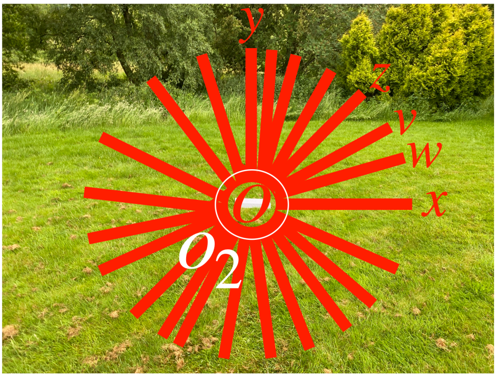
If a point or sphere is the centre of another sphere, then the dimensity will be infinite, even if the larger sphere is only marginally larger than the sphere it encapsulates.

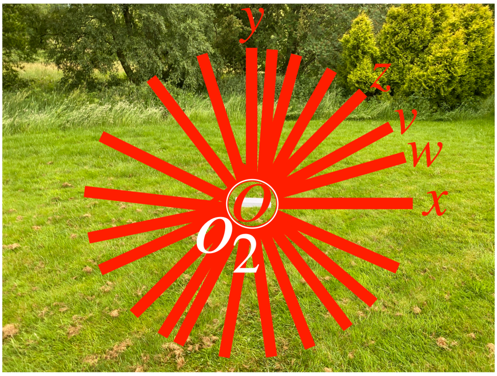
As shown on the following page, if O_2 were only marginally larger than O, there would still be infinite dimensity, but the axes or radiuses connecting O to O_2 would be smaller, as we saw on pages 15 and 16.





As shown in the top right image, if we make the sphere O_2 about half as big, the original axes which were drawn start to get crammed together. And if one makes O_2 even smaller as shown in the bottom left image below, the axes will become so crammed that they will start to marge together.





It does not matter how thin we draw the red axis lines. As O_2 continues to shrink smaller and smaller until it is almost equal to O, the axes will always eventually be too big and start to merge together.

At the same time, thinner or smaller red axis lines can be drawn to get past this and then the dimensity will appear just as infinite.

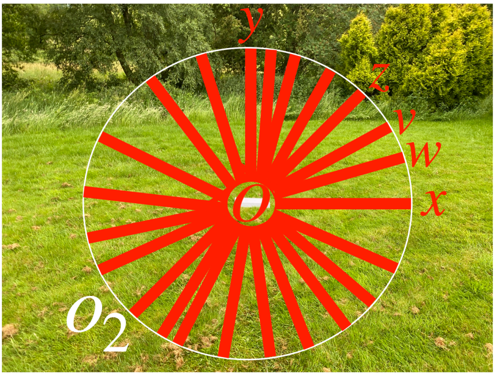
So what is occurring? The dimensity is always infinite unless O_2 is exactly equal to O, but the number of dimensions still falls, which leads one to the conclusion that the infinite number of dimensions in smaller spheres are smaller than the infinite dimensions of larger spheres.

In Mathematics, there are already instances where infinite quantities are larger than other infinite quantities.

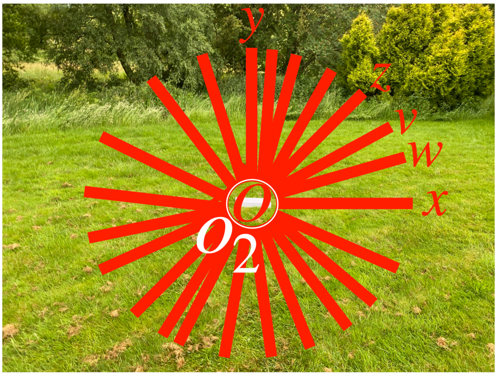
For instance, the set of positive rational numbers is larger than the set of positive integers. Both are infinite, yet the set of positive rational numbers includes the set of positive integers, as all integers are divisible by 1. Therefore, the infinite quantity of rational numbers in the set of positive rational numbers is larger than the infinite quantity of integers in the set of positive integers. In a similar fashion, the infinite quantity of dimensions displacing O and O_2 varies based on how large O_2 is relative to O.

If O exists within a significantly larger O_2, then O shall be said to exist inside of a *high dimensity* relative to O_2.

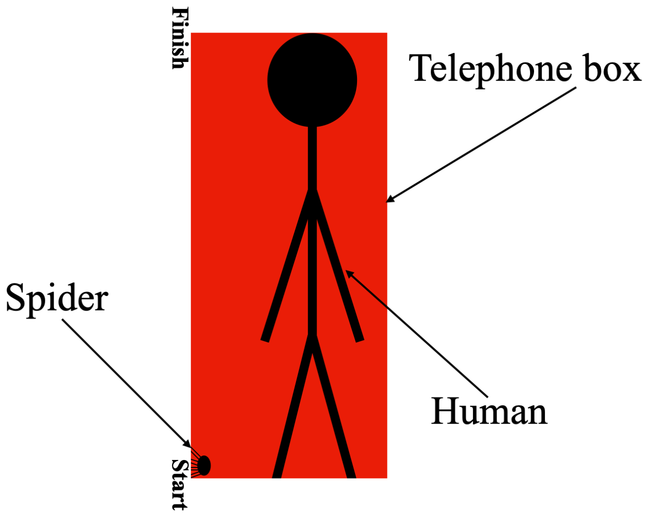
If, on the other hand, O_2, is only marginally larger than O then O shall be said to exist inside of a *low dimensity* relative to O_2.



O inside a *high dimensity* relative to O_2



O inside a *low dimensity* relative to O_2



A car, for instance, is a low dimensity for a human, but a high dimensity for an ant.

Earth exists in a high dimensity relative to our Solar System as it is small relative to the rest of the Solar System. The Sun, however, accounts for a very large proportion of the Solar System. Therefore, the Sun exists in a low dimensity relative to the Solar System. The Milky Way, however, is huge relative to our Sun, so the Sun exists in a huge dimensity relative to the Milky Way.

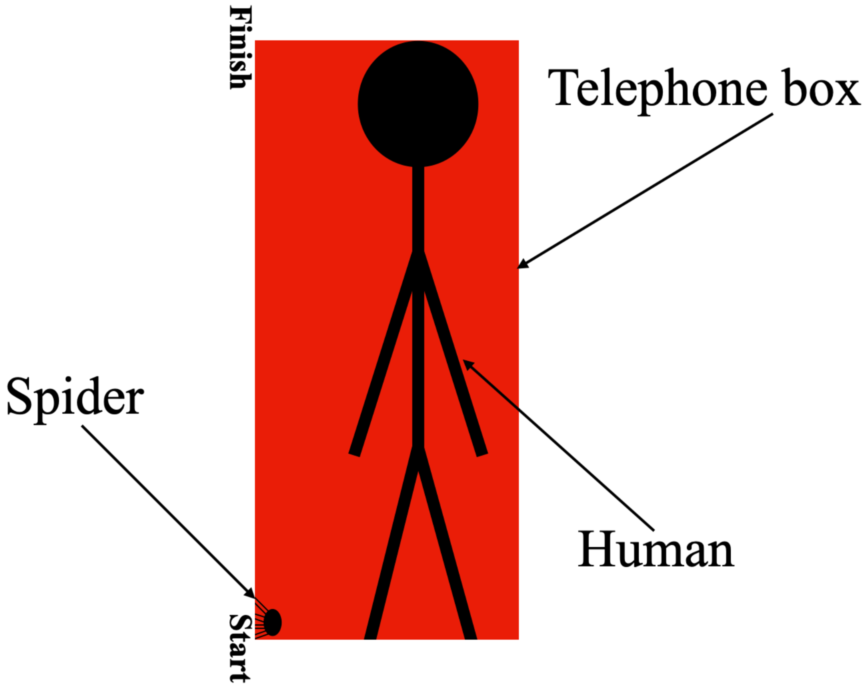
High dimensities provide small spaces or objects more dimensions to move in.

If a space or object is only marginally smaller than the space or object it occupies (i.e a low dimensity) then there will be little space for that object or space or object to move in.

To a human, a telephone box would be a low dimensity, providing very little room for the human to move in or explore.

To a small spider, however, that same telephone box would be a massive place to move and explore, because it provides more dimensions relative to the spider than to the human.

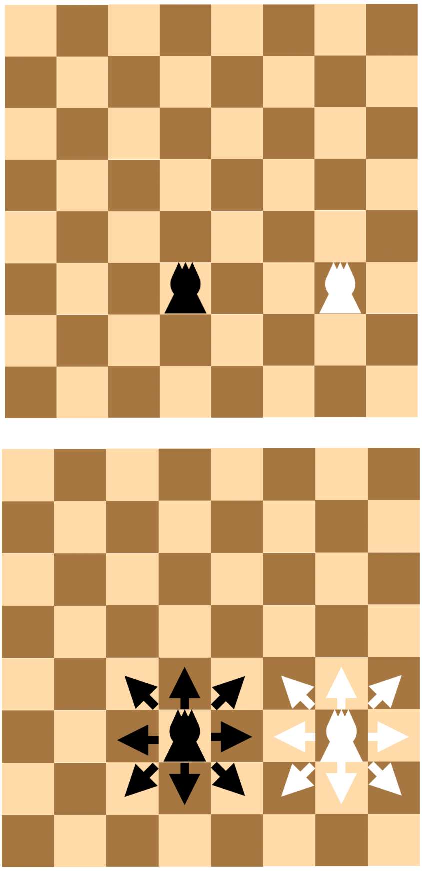
Let us suppose that both a small spider and a human are standing inside of a telephone box, and the human is tall enough that their head touches the roof of the telephone box. We suppose that the spider is to crawl from the floor of the telephone box to the roof of the telephone box. No matter how fast the spider moves, the human is already there at both the starting line and the finishing line. So in a race from the bottom of the telephone box to the top of the telephone box, the human in this example will always win. The human, unlike the spider, does not need to increase or decrease their speed to win the race.



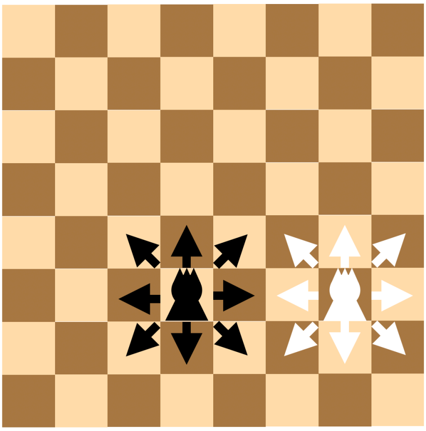
Larger objects or spaces have what I refer to as an *engulfing effect* on smaller objects or spaces.

The *engulfing effect* is such that the dimensions of a large object's trajectory engulf the dimensions of smaller objects.

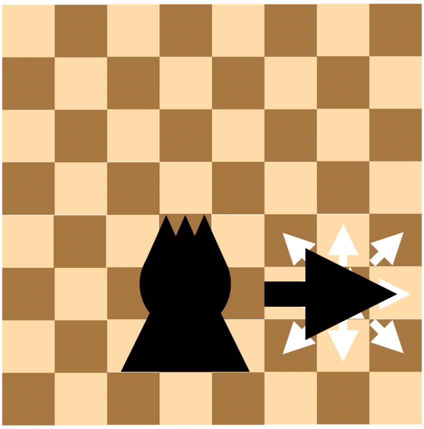
Imagine a game of chess where there is only a white king and a black king. And each column, row and diagonal of the chessboard relative to each piece is a different dimension. In this case, the number of possible dimensions each king can move in is limited to eight — a king can move one space in four diagonal directions, two vertical directions and two horizontal directions.



Equally-sized pieces



Equally-sized pieces



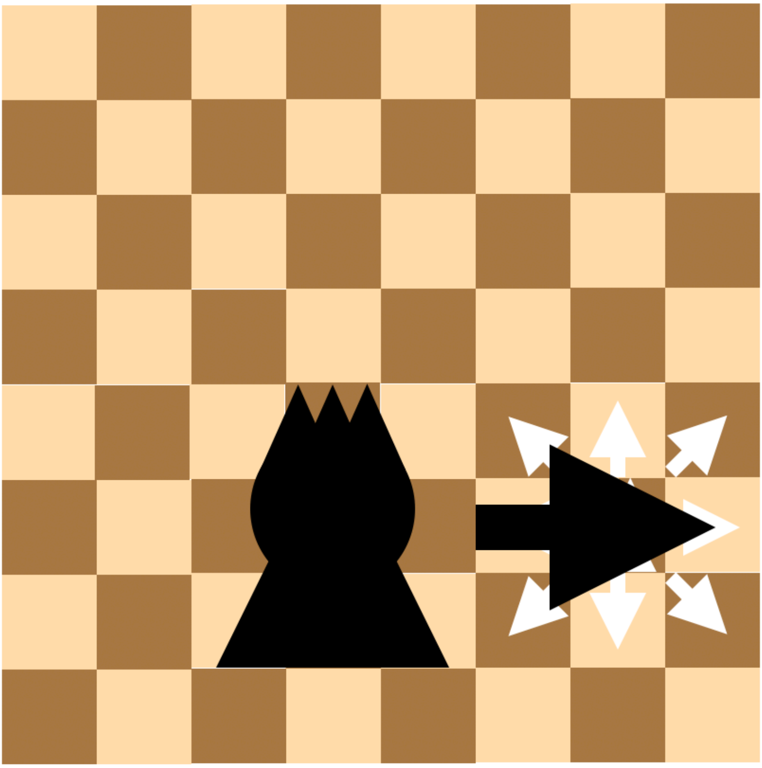
Engulfing effect

In the top left image above we have all of the possible trajectories of the black king piece and all of the possible trajectories of the white king piece. Each possible trajectory per piece is in a different dimension. Each piece therefore can move in eight different dimensions. The outcome of this game cannot be decided in a single move as both pieces are of equal size, both are displaced by two squares, and a king can only move one square at a time.

However, if the black king were 3×3 squares large as shown in the top right image, then the equivalent of one move to the black king now takes up 9 squares. Therefore, the black king will take the white king in a single turn irrespective of whose turn it is.

If it is the black's turn, then the white king will be taken in a single move. If it is the white's turn, then the white king piece can only be moved one space relative to its own size and will be taken by the black king in the following turn.

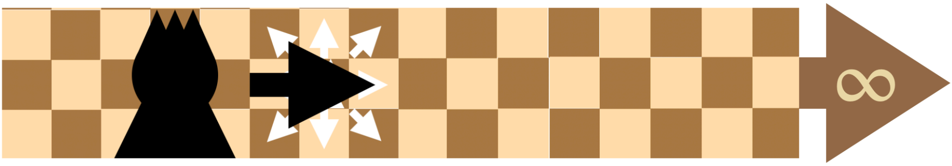
Because the black king piece is now larger, its trajectory now encapsulates all of the possible trajectories of the white king.



A single dimension relative to the black king swallows up the dimensions of the white king, as well as the eight possible dimensions for the white king to move in. This is an example of the *engulfing effect* —- a single dimension outside of the black king is equivalent to all eight dimensions outside of the white king and the dimensions of the white king itself.

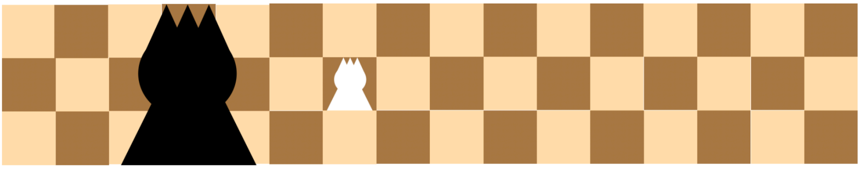
To not be taken by the black king, the white king would now have to travel more than one square in a single turn.

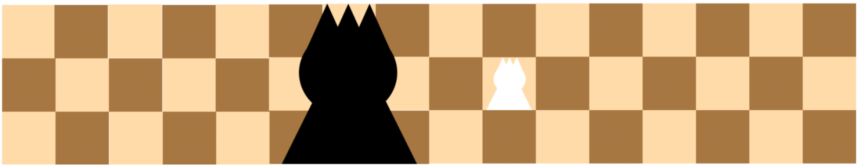
In the real world, however, our current understanding of motion is not turn-based as in a board game. Instead, speed is calculated by measuring the distance travelled by an individual body over a time interval experienced by humans.

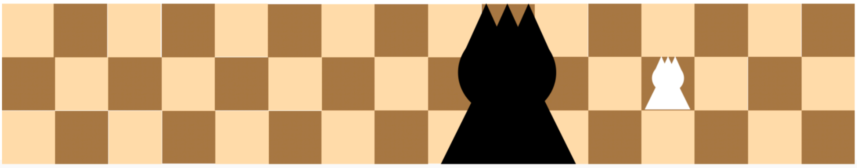


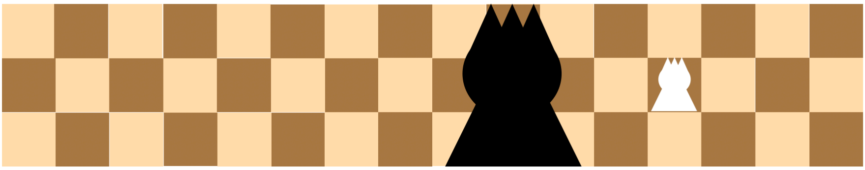
Let us suppose that the chessboard was three squares vertically and had infinite squares horizontally, and we wanted to create a simulation of both pieces moving at the same speed. To make both pieces appear as though they were moving at the same speed, we would ensure that at the end of each of the player's turns, both pieces maintained the same displacement in squares as they moved horizontally across this board.

To simulate this, the white king would have to move 3 squares to the right for every turn the black king moved a 3x3 square to the right. Now suppose that both player's turns merged together so that both pieces were moved at the same time as shown below. Suppose also, that each of the three images below are not only a turn, but a 1 second interval.









One would come to the observation that both pieces were moving at the same speed, as each piece moves 3 squares horizontally in each of the 3 intervals as shown on the previous page. And if each interval were a second then each piece would be travelling at 3 horizontal squares per second.

However, according to the chessboard, the black king is only travelling one horizontal square proportional to its own size (i.e one 3×3 square), whereas the white king is travelling three horizontal squares proportional to its own size (i.e three 1×1 squares). From that perspective the white king is travelling faster than the black king. Therefore, relativistically, the white king travels at 3 horizontal squares per second and the black king only travels 1 horizontal square per second.

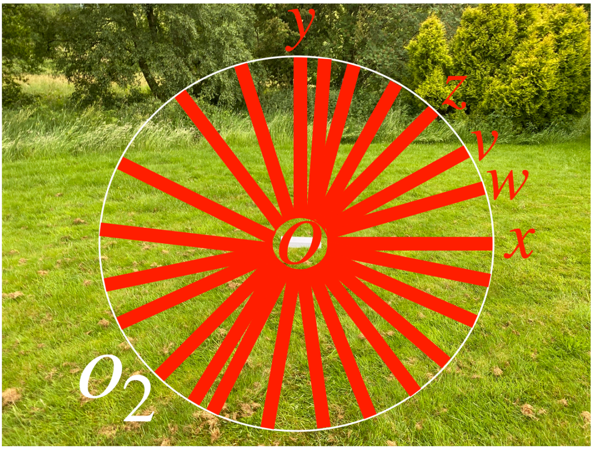
Yet these two relativised speeds balance out to appear as though both pieces are moving at the same speed.

This introduces the idea that what we observe to be *two* objects or spaces of *different size* moving at the

same speed is a *balance of two relativistic speeds*.

This also implies the idea of displacement being proportional to the size of an object —- that the distances a small object or space experiences are much larger than the same distances being experienced by an astronomical object or space. Both of these ideas are explored in great detail in Chapter 2.

The *engulfing effect* also applies to the O_2 sphere from earlier. O_2 encapsulates all of the possible trajectories of O. O_2 therefore has an *engulfing effect* on O.

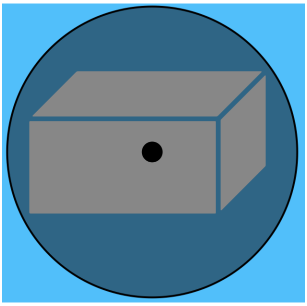


As we saw previously, if an object or space exists within a much larger object or space, then the smaller object or space is said to exist inside a *high dimensity*.

If, on the other hand, the larger object or space is only marginally larger than the object or space contained within it, then the smaller object or space shall be said to exist inside a *low dimensity*.

So far we have observed dimensions in terms of what is outside an object or space.

But what about the object or space itself? As I mentioned earlier, even ‘3D’ objects are not merely 3D. This is because any ‘3D’ object such as the white box from earlier can fit inside a sphere proportional to its size. We established earlier that spheres have infinite dimensions. It must therefore follow that any ‘3D’ object which can fit inside a sphere must also have infinite dimensions. This is demonstrated on the following page.



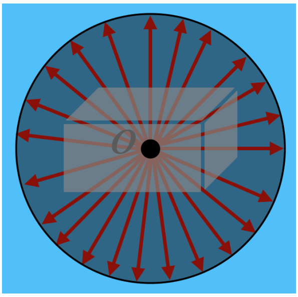
Imagine a ‘3D’ box inside a sphere such that the centre of the sphere is inside the box. The centre of the sphere is the origin point which all axes extend out of.

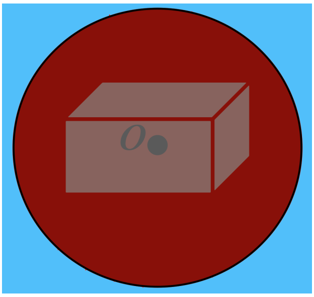
As we saw earlier, there are infinite radiuses in a sphere where each and every radius is a dimension from the centre of the sphere to the boundary of that sphere. A sphere must have infinite radiuses as it has infinite points on its surface. Therefore, there must be infinite lines or radiuses connecting the centre of the sphere to each point on the sphere’s surface.

As all of the radiuses (dimensions) from the origin point at the centre of the sphere must pass through the box to get to the surface of the sphere, it must follow that the box also has infinite dimensions.

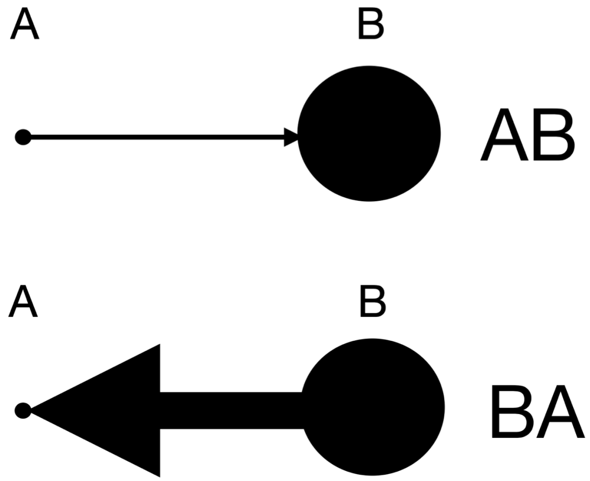
As all physical objects or spaces can fit inside a sphere proportional to their own size, they must therefore all have infinite dimensions.

The next chapter introduces the idea of ‘relative displacement’ and the implications this has for the motion of objects and spaces.





2 — Relative Displacement and Relativised Motion



When measuring displacement such as the distance between two differently-sized bodies, objects or spaces, we do not often consider how the distance may appear or be experienced differently depending on the size of either body.

In the image above, the distance between the two differently-sized points *A* and *B* is longer proportional to *A* than to *B*. Equally, the distance between *A* and *B* is shorter proportional to *B* than to *A*.

If we were to measure our distance from an ant 2 metres away from us, the distance experienced by the ant would be significantly more times the ant's body length than any body length of our own.

The goal of relative displacement is to convert a universal measurement of a distance or displacement (eg: metres) into a measurement proportional to the size of the body in question. Relative displacements for bodies of a vastly different size (eg: a planet and a galaxy) are then compared to highlight the significant disparities.

By converting a measurement of displacement into a measurement proportional to the body in question, it enables us to better understand how differently-sized objects or spaces experience the same distance. To understand our own perspective of distance, we must understand the perspectives of others.

Throughout this chapter, when I refer to the relative displacement experienced by a human, I am referring to an adult of average height and width across the whole species and measuring their relative displacement. The method that I will use for measuring relative displacement is aimed primarily at instances where there are extreme disparities in the size of two bodies, objects or spaces.

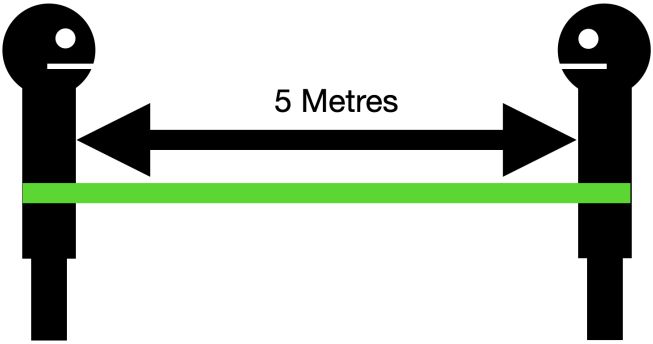
One will see later in this chapter that motion can also be measured proportional to a body in the same fashion as displacement, such as a body's change in relative displacement over time.

For two objects or spaces of very similar sizes, relative displacement is generally treated as being the same for both objects or spaces.

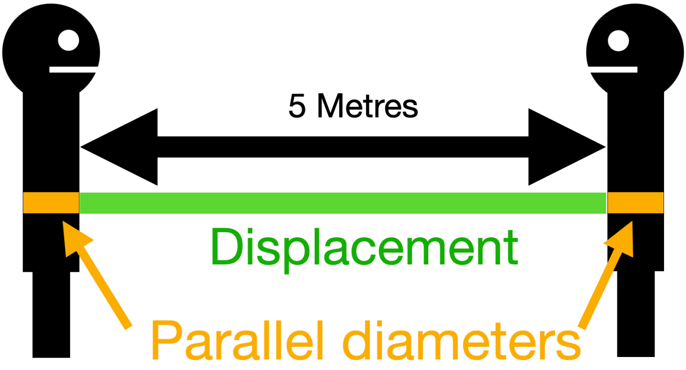
To calculate relative displacement, we first of all imagine a straight line passing through both bodies.

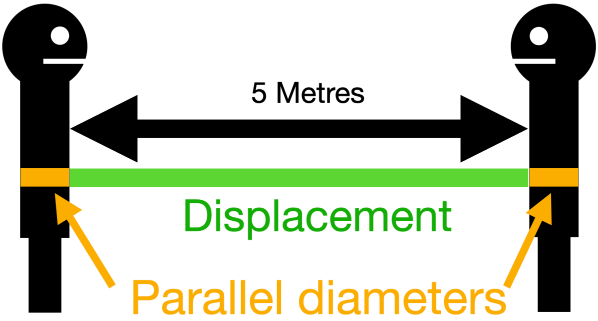
Let us begin with an easy example. Imagine two humans are horizontally displaced by 5 metres and both are facing each other.

Now, imagine a green, straight line parallel to the displacement passing through each of them such that the beginning of the green line begins at the back of one human and ends at the back of the other human.



We then split the green line up into three segments, the part of the line which passes through the first human, the displacement itself and the part of the green line which passes through the second human. We colour the parts of the green line which pass through the humans yellow to get something which looks like this:





The parts of the green line which passed through the humans, now coloured yellow, are referred to as ‘parallel diameters.’ The diameters used to calculate ‘relative displacement’ are always inline with the displacement and parallel to each other.

In this instance, we are only interested in finding the horizontal relative displacement for each human which corresponds to the horizontal displacement of 5 metres.

In this case, the parallel diameters are the lengths of each human’s sides (the length from back to stomach).

Let us suppose both humans are about the same in shape, and that the length from back to stomach for each human is about 0.3 metres. Then the parallel diameter of each of the two humans is 0.3 metres.

Once the displacement and parallel diameters are measured, one can then work out the relative displacement experienced by each human.

The method I use to calculate relative displacement is by dividing the displacement in metres by the human’s parallel diameter.

$$relative\ displacement = \frac{displacement}{parallel\ diameter}$$

The unit of measurement for measuring relative displacement, denoted D^*, is 'parallel diameters' (pdm). Therefore, a distance of s metres to a body with a parallel diameter of p metres, corresponds to a relative displacement of s/p pdm:

$$relative\ displacement = D^* = \frac{s}{p}$$

Therefore, the relative displacement for each human is:

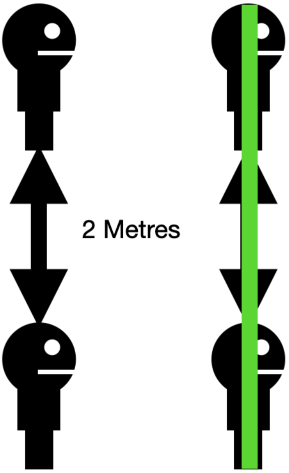
$$relative\ displacement = \frac{displacement}{parallel\ diameter} = \frac{5}{0.3}$$

$$= 16.6666\ldots \text{ pdm}$$

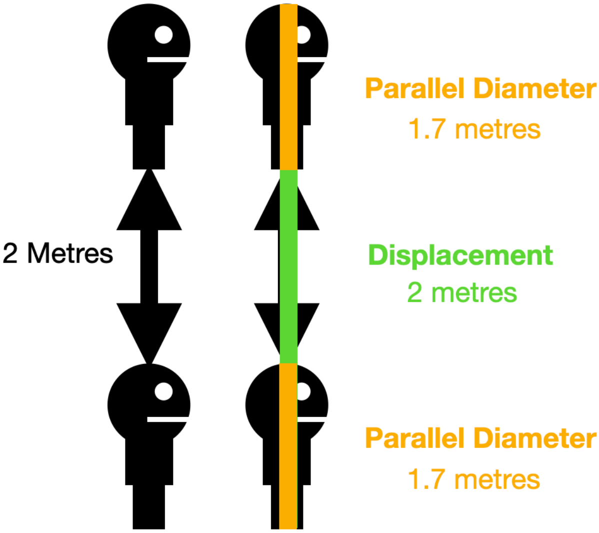
Thus, the displacement of 5 metres for each human is about 16.67 times their parallel diameter. Therefore, the relative displacement for each human is 16.67 pdm.

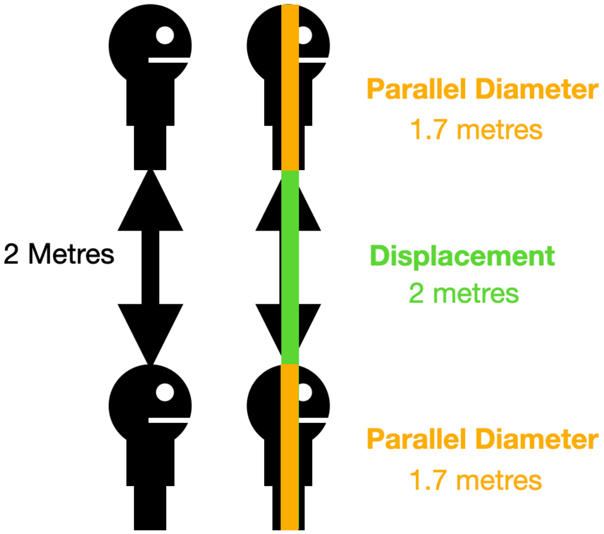
If each human's parallel diameter were 0.5 metres then they would experience a shorter relative displacement of 10 pdm.

If two humans are vertically displaced by 2 metres, then their parallel diameters are now their individual heights. The green line from earlier now passes through each of their heights as shown on the following page.



We then split the green line up into three segments again; the part of the line which passes through the first human, the displacement itself and the part of the green line which passes through the second human. We colour the parts of the green line which pass through the humans yellow to get something which looks like this:





In this instance, we are only interested in finding the vertical relative displacement which corresponds directly to this particular displacement. We suppose that the height of each human is 1.7 metres. The parallel diameters are the height of each human (1.7 metres) as these are inline with the displacement of the 2 metres.

The relative displacement for each human is therefore as follows:

$$relative\ displacement = \frac{displacement}{parallel\ diameter} = \frac{2}{1.7}$$

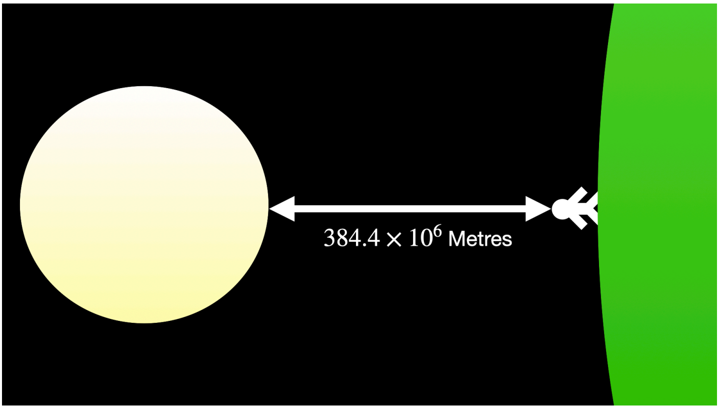
$$= 1.1764\ldots \text{ pdm}$$

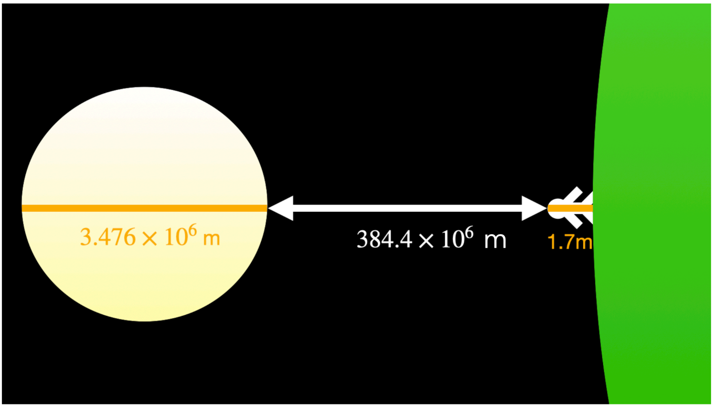
Therefore, the relative displacement for each human is approximately 1.18 pdm.

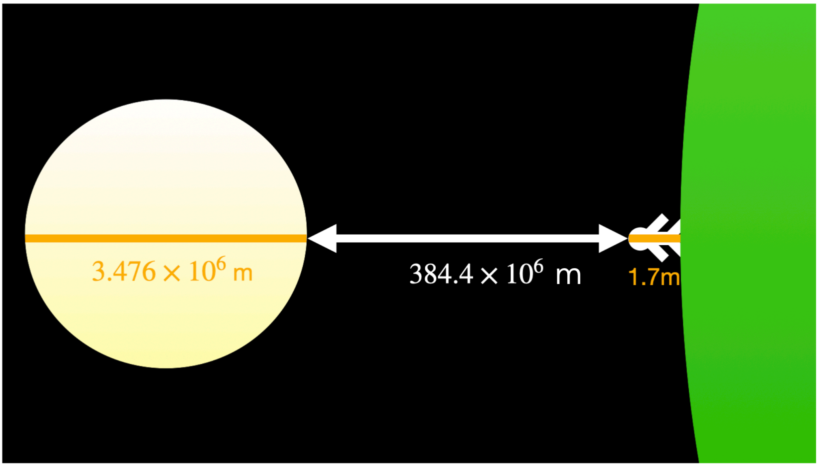
Let us consider two different bodies of vastly different size.

The pictures below are obviously not drawn to scale, but let us suppose the moon and a human are both vertically displaced by 384.4×10^6 metres such that the moon is modelled to be directly above the human and the distance is modelled as a straight line.

We then measure the parallel diameter of each body. In this case, the two bodies are the moon and the human. We take the parallel diameter of the human to be the human's height. This is because their height is inline with the displacement. We take the height of the human to be 1.7 metres. We suppose that the moon's parallel diameter is 3.476×10^6 metres.







For the relative displacement experienced by the human, we do the same as we have done before. We divide the displacement by their parallel diameter, which in this case, is their height of 1.7 metres.

$$human's\ relative\ displacement = \frac{displacement}{human's\ parallel\ diameter}$$

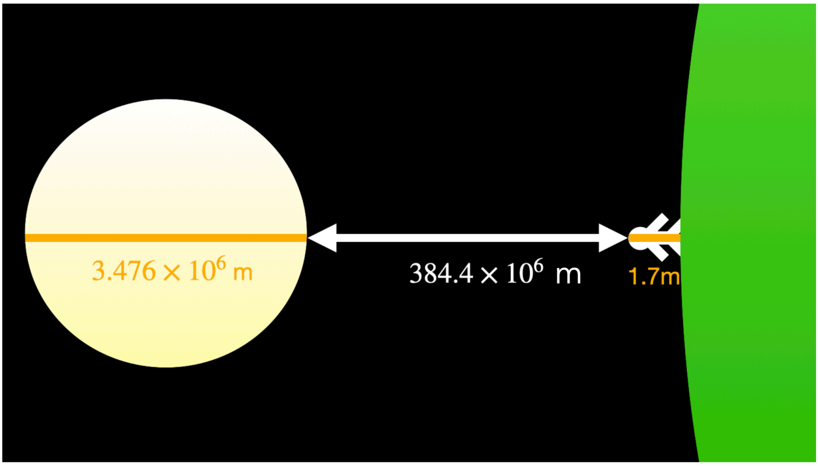
$$= \frac{384.4 \times 10^6}{1.7} = 226117647.1 \text{ pdm}$$

So the relative displacement experienced by the human is about 226×10^6 pdm.

For the moon's relative displacement, we do the same process as we did for the human — we divide the displacement by the moon's parallel diameter:

$$moon's\ relative\ displacement = \frac{displacement}{moon's\ parallel\ diameter} = \frac{384.4 \times 10^6}{3.476 \times 10^6}$$

$$= 110.586\ldots \text{ pdm}$$

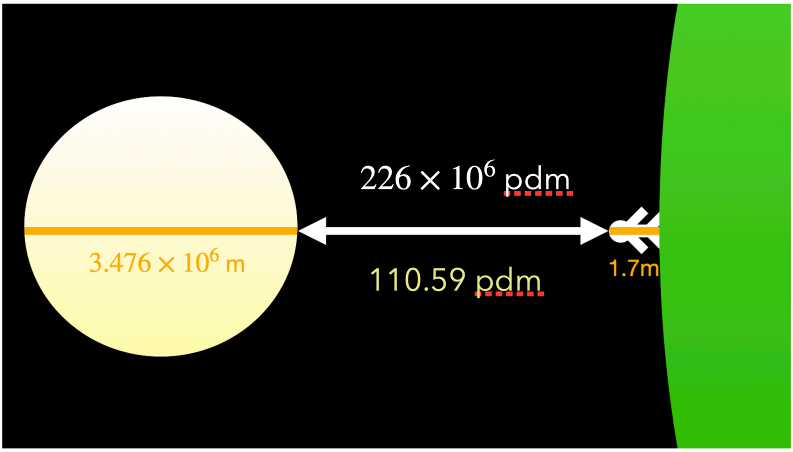


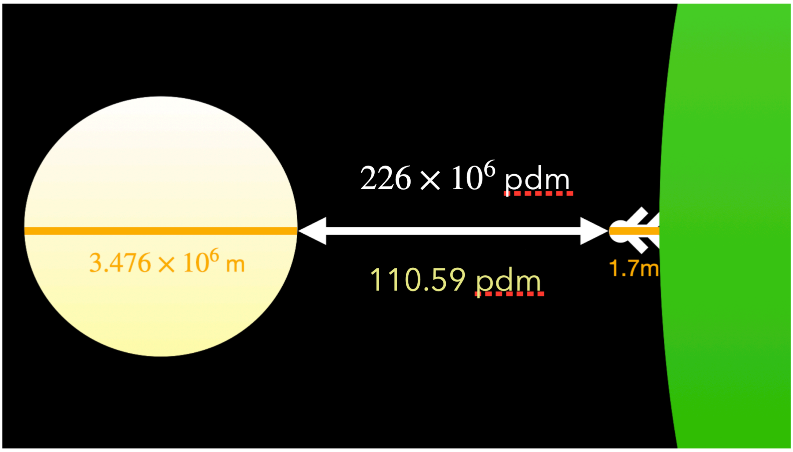
Therefore, the moon's relative displacement for this scenario is approximately 110.59 pdm.

This means that the relative displacement experienced by the human for this scenario is about 2 million times the relative displacement experienced by the moon.

Therefore, for this scenario, the distance the moon experiences from the human is significantly less than the distance the human experiences from the moon.

Relative displacement therefore shows that what may be a very long distance to a human is significantly shorter to a much larger body.





So far we have compared the moon's relative displacement to that of a human in one static scenario.

But what about the relative displacement between two objects or spaces which are celestial bodies?

Let us suppose that for the same scenario we now want to measure the relative displacement of the Earth from the moon.

The 1.7 metres of the human's height makes very little difference to 384.4×10^6 metres, so we will model the displacement as being the same as before.

We suppose that the Earth's parallel diameter to the displacement of 384.4×10^6 metres is about 12.7×10^6 metres.

For the Earth's relative displacement, we repeat the process as we did for the human and the moon — we divide the displacement by the Earth's parallel diameter:

$$Earth's\ relative\ displacement = \frac{displacement}{Earth's\ parallel\ diameter} = \frac{384.4 \times 10^6}{12.7 \times 10^6}$$

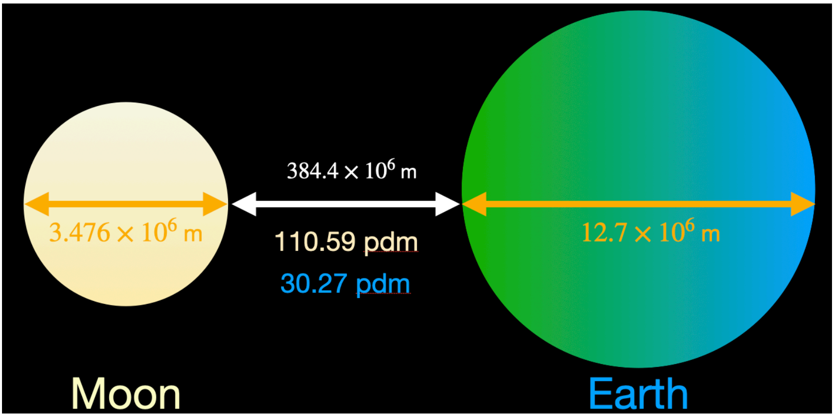
$$Earth's\ relative\ displacement = \frac{displacement}{Earth's\ parallel\ diameter} = \frac{384.4 \times 10^6}{12.7 \times 10^6}$$

$$= 30.2677\ldots \text{ pdm}$$

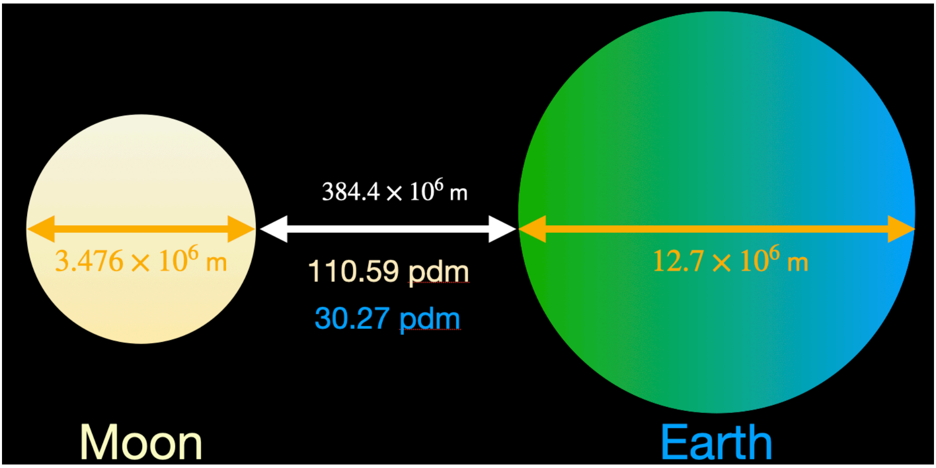
Therefore, in this scenario the Earth's relative displacement to the moon is approximately 30.27 pdm.

This means that the relative displacement experienced by the moon for this scenario is about 3.65 times larger than the relative displacement experienced by Earth. Furthermore, the relative displacement experienced by the human is about 7.4 million times that of Earth.

The diagram below is obviously not drawn to scale but provides a visualisation of the calculations.



Now that we have the general idea of relative displacement, we can use it to measure other aspects of a body, object or space. One can now measure two forms of motion which are based on relative displacement. The first being the change in *relative distance travelled* by a body over a time interval. The second being the change in *relative displacement between* two bodies over a time interval.



For simplification, when I refer to 'velocity' throughout this paper, I am usually referring to a speed or magnitude (absolute value), and will specify the direction of motion separately.

The first new form of motion which we can now measure is what I refer to as '*relativised velocity*' or '*relaticity*' for short.

Unlike regular velocity or speed, relaticity is a velocity measured proportional to a body's parallel diameter —- it is the distance an object or space travels divided by their parallel diameter over a time interval.

$$\text{'Relativised velocity'} = \text{'Relaticity'} = \frac{\left(\dfrac{\textit{distance travelled}}{\textit{parallel diameter}}\right)}{\textit{time interval}}$$

$$= \frac{\textit{velocity}}{\textit{parallel diameter}}$$

Relaticity is a body's velocity in metres per second divided by their parallel diameter. It is also the change in an object or space's relative distance over a time interval. As relative distance is measured in parallel diameters (pdm), the unit of measurement for relaticity is therefore parallel diameters per second ($pdms^{-1}$). The notation I use to denote relaticity is $R(v)$. This is because velocity, v, goes into the equation $relaticity = \dfrac{v}{parallel\ diameter}$, so in a sense, relaticity is a function of velocity.

$$\text{Relaticity} = \frac{\Delta\ relative\ distance}{\Delta\ time}$$

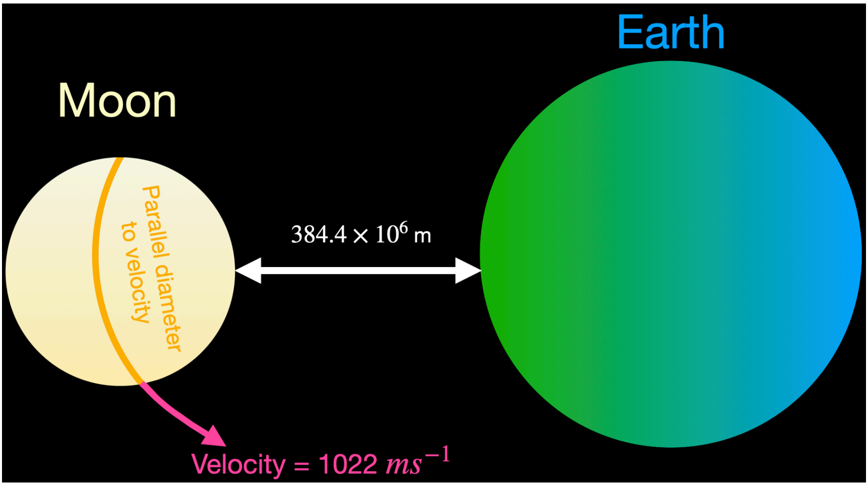
$$= \frac{velocity}{parallel\ diameter} = R(v)\ \ pdms^{-1}$$

Now we shall apply the idea of 'relaticity' to to our scenario from earlier.

Let us suppose that the moon is orbiting the Earth at a speed of 1022 ms^{-1}.

We first have to work out the parallel diameter corresponding to its trajectory.

As the moon orbits the Earth, the parallel diameter corresponding to the moon's trajectory will therefore be modelled as a curved line as shown on the following page.



As shown in the image above, we suppose that the moon is moving at a speed of 1022 ms^{-1} as it orbits the Earth. We assume the moon's motion appears curved. In this case, the parallel diameter of the moon inline with its trajectory is also curved, so the moon's relaticity in this situation is 1022 divided by the length of the curved orange line in the image above, the moon's parallel diameter.

Let us suppose that the length of this orange line was about $4{\times}10^6$ metres (this is just a guess). The moon's relaticity would be

$1022/(4{\times}10^6) = 2.555 \times 10^{-4}\ pdms^{-1}$.

Therefore, proportional to the parallel diameter of the moon, the moon's velocity is very slow.

If a human were travelling at 1022 ms^{-1} and their parallel diameter to their motion was 0.4 metres, this would equate to a significantly higher relaticity of 2555 $pdms^{-1}$.

This implies that bodies as large as the moon would experience a speed of 1022 ms^{-1} significantly slower than a human would. Unlike the moon, a human would experience 1022 ms^{-1} to be considerably fast.

We can also measure what I refer to as ‘*relativised acceleration*’ or ‘*receleration*’ (reh-celeration) for short.

Unlike regular acceleration, receleration is the acceleration of a body proportional to that body’s parallel diameter. It is the change in a body’s velocity divided by their parallel diameter over a time interval.

$$\text{‘Relativised acceleration’} = \text{‘Receleration’} = \frac{\left(\frac{change\ in\ velocity}{parallel\ diameter}\right)}{time\ interval}$$

$$= \frac{acceleration}{parallel\ diameter}$$

Receleration is a body’s acceleration in metres-per-second-squared divided by their parallel diameter. It is also the change in an object or space’s relaticity over a time interval. As relaticity is measured in parallel diameters per second ($pdms^{-1}$), the unit of measurement for receleration is therefore parallel diameters per second-squared ($pdms^{-2}$).

The notation I use to denote receleration is $R(a)$. This is because acceleration, a, goes into the equation $receleration = \frac{a}{parallel\ diameter}$, so in a sense, receleration is a function of acceleration.

$$\text{Receleration} = \frac{\Delta\ relaticity}{\Delta\ time} = \frac{\Delta\ R(v)}{\Delta\ t} = R(a)\ \ pdms^{-2}$$

We can now apply the concept of ‘receleration’ to bodies or spaces such as galaxies which are accelerating away from us due to the expansion of the universe. The accelerating expansion of the universe with regards to receleration and another new form of acceleration which becomes apparent on page 54, are explored in the third chapter of this paper ‘Dark Energy, Gravitational Thrust and Before the Big Bang.”

Let us suppose that the NGC 7513 galaxy is accelerating away from the Sun at $\alpha\ ms^{-2}$ and its parallel diameter to this acceleration is 75,000 light years, which is about 7.095×10^{20} meters. Then NGC 7513’s receleration would be $\dfrac{\alpha}{7.095 \times 10^{20}}\ pdms^{-2}$.

I could not find any information on NGC 7513’s acceleration but according to a NASA article credited to the European Space Agency, written on July, the 10th 2020,

NGC 7513 is said to be moving at a speed of 972 miles per second and is heading away from us.

972 miles per second in metres per second is approximately $1.5 \times 10^{6}\ ms^{-1}$. If we were to assume that NGC 7513’s diameter parallel to its velocity was 7.095×10^{20} meters, then NGC 7513’s relaticity would be $\dfrac{1.5 \times 10^{6}}{7.095 \times 10^{20}}\ pdms^{-1}$, which is $2.114 \times 10^{-15}\ pdms^{-1}$.

This means that the speed of $1.5 \times 10^{6}\ ms^{-1}$ which the NGC 7513 galaxy is measured to travel is equivalent to only $2.114 \times 10^{-15}\ pdms^{-1}$. This is significantly slower than what we would experience travelling $1.5 \times 10^{6}\ ms^{-1}$ proportional to any parallel diameter of our own. This shows that what may be very fast for us to travel would be very slow for a galaxy such as NGC 7513 to travel.

Suppose a car is accelerating at 4 ms^{-2}. To obtain the car's receleration we would divide its acceleration by the car's parallel diameter to the acceleration.

Assuming the car was driving straight, the parallel diameter to the car's acceleration would be the length of the car from the front to the boot. If we suppose this length was 4.5 metres, then the car's receleration would be $4/4.5 = 0.888\ldots pdms^{-2}$.

Suppose a human is walking and accelerates 4 ms^{-2}. We suppose also that their parallel diameter to their motion is the length from their front to their back, which is 0.45 metres. Therefore, their receleration would be $4/0.45 = 8.888\ldots pdms^{-2}$.

This means that for the same acceleration of 4 ms^{-2}, the human's receleration is 10 times that of the car. Therefore, the car experiences the acceleration of 4 ms^{-2} slower than what the human experiences.

Bodies, objects or spaces with longer parallel diameters experience a given acceleration slower than those with smaller parallel diameters.

Earlier I mentioned that one can measure two forms of motion which are based on relative displacement. The first being the change in *relative distance travelled* by a body over a time interval. The second being the change in *relative displacement between* two bodies over a time interval.

We have so far explored the first category, which concerns velocity and acceleration experienced by individual bodies, objects or spaces (relaticity and receleration). Now we will explore the second category, which concerns the change in relative displacement between two bodies, objects or spaces over a time interval.

The second new form of motion which we can now measure is what I refer to as '*spatial velocity*' or '*spalocity*' (spa-locity) for short.

Unlike regular velocity or relaticity, *spalocity* is the change in relative displacement between two bodies, objects or spaces over a time interval for the body, object or space whose *spalocity* one is trying to measure.

$$\text{'Spatial Velocity'} = \text{'Spalocity'} = \frac{\left(\frac{\textit{change in distance from an object}}{\textit{parallel diameter}}\right)}{\textit{time interval}}$$

$$= \frac{\textit{change in relative displacement from an object}}{\textit{time interval}}$$

Spalocity, unlike velocity or relaticity, does not require one to be in motion to have it. Spalocity is electromagnetic in the sense that it is motion based on bodies repelling or moving towards each other (attraction). Even if one of the bodies remains stationary, if the other body moves towards or away that body then both bodies will have a spalocity.

If a car moves away from a stationary human, both the car and the human have a spalocity for that particular instance.

Spalocity where a body, object or space is moving away from a stationary body, object or space in a straight line is the most straightforward to calculate.

For the body, object or space moving away from the stationary body, object or space, their spalocity would be the same as their relaticity.

For the stationary body, the spalocity would be the moving body's velocity divided by the parallel diameter of the stationary body.

Suppose we have two bodies, objects or spaces, A and B. A's relative displacement is measured in parallel diameters (pdm). The unit of measurement for spalocity is therefore parallel diameters per second ($pdms^{-1}$).

The notation I use to denote spalocity is $S(v)$. This is because in a sense, spalocity is a function of velocity.

The spalocity of A with respect to B is as follows:

$$\text{Spalocity of } A = \frac{\Delta\ A's\ relative\ displaecemnt\ from\ B}{\Delta\ time}$$

$$= \ S(v) \ \ pdms^{-1}$$

For shorthand, one can denote

A's relative displacement from B as 'D_A':

$$\text{Spalocity of } A = \frac{\Delta D_A}{\Delta t}$$

Similarly, the spalocity of B with respect to A is

B's change in relative displacement from A, ΔD_B, over a time interval, Δt.

A's spalocity is denoted as $S_A(v)$, whereas B's spalocity is denoted as $S_B(v)$.

Let us suppose that at time t = 0 seconds, the NGC 7513 galaxy and the Sun are displaced by 60 million lightyears, which is approximately 5.6×10^{23} metres.

Given that the distance between the Sun and Earth is very small in comparison to 60 million lightyears, we will model the distance of 60 million lightyears to NGC 7513 as being roughly the same for Earth.

We suppose that NGC 7513 moves at a speed of $1.5 \times 10^{6}\ ms^{-1}$ away from Earth after Earth's motion has been taken into consideration.

We assume that NGC 7513's parallel diameter to its motion of $1.5 \times 10^{6}\ ms^{-1}$ is 7.095×10^{20} meters.

Given that we have modelled NGC 7513's speed of $1.5 \times 10^{6}\ ms^{-1}$ as taking the Earth's motion into consideration, we can model NGC 7513 as moving at a speed of $1.5 \times 10^{6}\ ms^{-1}$ ahead of the Earth in a particular direction.

We assume the Earth's parallel diameter to the motion of NGC 7513 is 12.7×10^{6} metres.

Therefore, the Earth's relative displacement, D_E, at the

time t = 0 seconds is $D_E = \dfrac{5.6 \times 10^{23}}{12.7 \times 10^{6}} = 4.41 \times 10^{16}\ pdm.$

NGC 7513's relative displacement, D_N, at the

time t = 0 seconds is $D_N = \dfrac{5.6 \times 10^{23}}{7.095 \times 10^{20}} = 789.29\ pdm.$

This means Earth's relative displacement from NGC 7513 for the same displacement is about 5.6×10^{13} times larger than NGC 7513's relative displacement.

Therefore, what the Earth experiences as a long distance away from it, is experienced as a very small distance to NGC 7513.

This implies that the universe is much more compact to large scale bodies than to significantly smaller bodies.

What may be an expanded universe to us is a less expanded universe to a larger structure.

Now supposing at time t = 1 second, NGC 7513 moves away from Earth 1.5×10^6 metres, what is its spalocity?

As I mentioned earlier, for an object or space moving away from a relatively stationary object or space in a consistent direction, their spalocity would be the same as their relaticity.

In this scenario, we have modelled NGC 7513's motion as taking the Earth's motion into consideration. Therefore, NGC 7513's spalocity is the same as its relaticity which we measured earlier to be $2.114 \times 10^{-15}\ pdms^{-1}$. Therefore, NGC 7513's spalocity, $S_N(v)$ is:

$$S_N(v) = R_N(v) = 2.114 \times 10^{-15}\ pdms^{-1}$$

Now what about the Earth's spalocity, $S_E(v)$?

At time t = 1 second, assuming NGC 7513's speed of $1.5 \times 10^6\ ms^{-1}$ fully takes Earth's own velocity into consideration, then Earth's velocity relative to NGC 7513 is zero. Therefore, Earth's relaticity will also be zero relative to NGC 7513. However, in this case, spalocity is not the same as relaticity. This is because as we established, spalocity for one of the two bodies is the change in that body's respective relative displacement from the other over a time interval.

To get the change in Earth's respective relative displacement over the same time interval, we therefore have to divide NGC 7513's velocity by Earth's parallel diameter. This will gives us Earth's spalocity, $S_E(v)$ as shown below:

$$S_E(v) = \frac{NGC\ 7513's\ speed}{Earth's\ parallel\ diameter}$$

$$= \frac{1.5 \times 10^6}{12.7 \times 10^6} = 0.1181 \ldots\ pdms^{-1}$$

Therefore, for this scenario, Earth's spalocity corresponding to its relative displacement from the galaxy, NGC 7513 is approximately $0.12\ pdms^{-1}$. This means that NGC 7513's spalocity of $2.114 \times 10^{-15}\ pdms^{-1}$ is significantly smaller than the Earth's spalocity of $0.12\ pdms^{-1}$.

The spalocities of galaxies are therefore significantly smaller than those of planets.

This suggests that the speed at which planets experience the space of the universe to expand is significantly faster than the speed at which larger structures such as galaxies experience the same space to expand.

Another words, what smaller bodies experience to be the expansion of the universe is significantly less of an expansion to larger structures.

Which brings us onto the next part of this chapter. Just as we can measure spalocity (a body, object or space's respective change in relative displacement from another body, object or space over a time interval), we can also measure the change in spalocity over a time interval.

I refer to the change is spalocity over a time interval as '*spatial acceleration*' or '*spaceleration*' (spa-celeration) for short. Unlike regular acceleration or receleration, *spaceleration* is the change in a body, object or space's spalocity over a time interval.

$$\text{'Spatial acceleration'} = \text{'Spaceleration'}$$

$$\text{'Spaceleration'} = \frac{change\ in\ spalocity\ from\ an\ object}{time\ interval}$$

$$\text{Spaceleration of A} = \frac{\Delta\ A's\ spalocity\ from\ B}{\Delta\ time}$$

Spaceleration, unlike acceleration, deceleration or receleration, does not require one to be in motion to have it. Spalocity is electromagnetic in the sense that it is motion based on bodies repelling or moving towards each other (attraction). Even if one of the bodies remains stationary, if the other body moves towards or away that body then both bodies will have a spalocity.

If a car accelerates away from a stationary human, both the car and the human have a spaceleration for that specific instance. Spaceleration where a body, object or space is moving away from a stationary body, object or space in a straight line is the most straightforward to calculate.

For the body, object or space accelerating away from the stationary body, object or space, their spaceleration would be the same as their receleration. For the stationary body, the spaceleration would be the moving body's acceleration divided by the parallel diameter of the stationary body.

The major application of *spaceleration* which we will explore in this paper is the accelerating expansion of the universe, known as *Dark Energy*.

As spalocity is measured in parallel diameters per second ($pdms^{-1}$), the unit of measurement for spaceleration is therefore parallel diameters per second-squared ($pdms^{-2}$).

The notation I use to denote spaceleration is $S(a)$. This is because in a sense, spaceleration is a function of acceleration:

$$\text{Spaceleration of } A = \frac{\Delta\ A's\ spalocity}{\Delta\ time}$$

$$= S(a)\ \ pdms^{-2}$$

$$\text{Spaceleration} = \frac{\Delta\ spalocity}{\Delta\ time} = \frac{\Delta\ S(v)}{\Delta\ t} = S(a)\ \ pdms^{-2}$$

In the earlier scenario, we calculated that Earth had a spalocity of $0.12\ pdms^{-1}$ relative to the NGC 7513 galaxy.

We also calculated that the NGC 7513 galaxy had a spalocity of $2.114 \times 10^{-15}\ pdms^{-1}$ relative to Earth.

NGC 7513's spalocity of $2.114 \times 10^{-15}\ pdms^{-1}$ corresponded to a radial velocity of $1.5 \times 10^{6}\ ms^{-1}$ relative to the Earth.

Now let us suppose that due to the accelerating expansion of the universe, NGC 7513's radial velocity relative to the Earth increased from $1.5 \times 10^{6}\ ms^{-1}$ to that of the NGC 2623 galaxy (5486 km/s) while the NGC 2623 galaxy also increased its speed to some higher radial velocity relative to the Earth over an interval of t seconds.

We also assume that NGC 7513's increased speed of 5486 km/s takes the Earth's motion into consideration, as we assumed was the case for NGC 7513's initial speed of $1.5 \times 10^{6}\ ms^{-1}$.

5486 km/s in meters per second is $5.486 \times 10^{6}\ ms^{-1}$.

If we also assume that the NGC 7513 galaxy maintains a similar direction for its new speed as with its initial speed then its parallel diameter to the new speed will be about the same as before.

In this case, NGC 7513's new spalocity, which is the same as its new relaticity, will be:

$$\frac{5.486 \times 10^{6}}{7.095 \times 10^{20}} pdms^{-1} = 7.732 \times 10^{-15}\ pdms^{-1}.$$

For this scenario, NGC 7513's spaceleration, $S_N(a)$ would therefore be the change in NGC 7513's spalocity divided by the time interval, t seconds as shown below:

Spaceleration of NGC 7513

$$= S_N(a) = \frac{7.732 \times 10^{-15} - 2.114 \times 10^{-15}}{t} pdms^{-2}$$

$$= \frac{5.618 \times 10^{-15}}{t} pdms^{-2}$$

$$= 5.618 \times 10^{-15}\ \ t^{-1} pdms^{-2}$$

The time it would take for NGC 7513 to spacelerate is debatable, hence I have chosen t = t. But given that we are using the same time interval for Earth, we will still be able to compare Earth's spaceleration against NGC 7513's.

Let $S_E(a)$ denote Earth's spaceleration over the same time interval, t.

In this case, given the Earth's motion has been taken into consideration, it's new spalocity will be NGC 7513's new speed divided by the Earth's parallel diameter to NGC 7513's motion, which is $\dfrac{5.486 \times 10^6}{12.7 \times 10^6} = 0.43\ pdms^{-1}$.

Therefore, Earth's spaceleration will be its new spalocity minus its old spalocity ($0.12\ pdms^{-1}$) over the same time interval, t.

Earth's spaceleration for this scenario, therefore, is $S_E(a) = 0.31\ \ t^{-1}pdms^{-2}$.

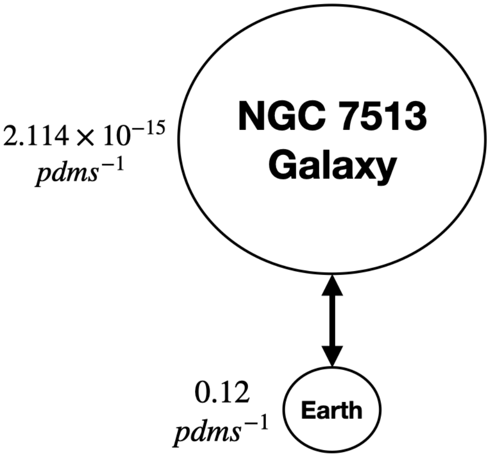
$$\text{Therefore,}\ \ S_E(a) > S_N(a),\ \text{as}$$

$$0.31\ \ t^{-1}pdms^{-2}\ >\ 5.618 \times 10^{-15}\ \ t^{-1}pdms^{-2}$$

This suggests that the expansion of the universe accelerates at a slower rate from the perspective of NGC 7513 than it does from the perspective of the Earth over the same time interval.

Another words, the larger one is, the smaller their relative displacement is to other bodies. The universe relative to bodies as large as the NGC 7513 galaxy would therefore not only experience the universe as less expanded but would experience the accelerating expansion of the universe at a slower rate than smaller bodies.

We can sketch a spaceleration diagram of this effect. We begin by showing the initial spalocities of NGC 7513 and Earth at the time t = 0 seconds:



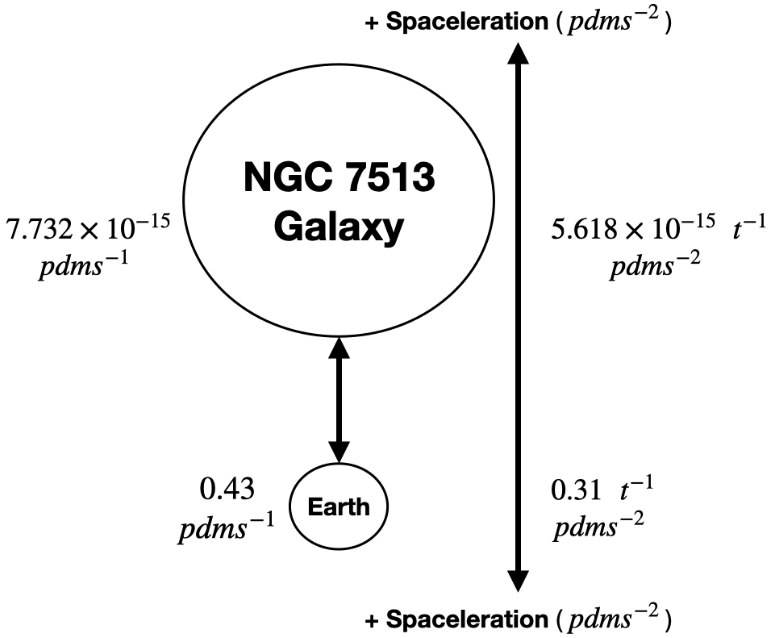
At time t = t seconds, NGC 7513 increases its spalocity to $7.732 \times 10^{-15}\ pdms^{-1}$.

NGC 7513 therefore has a spaceleration of $5.618 \times 10^{-15}\ \ t^{-1}pdms^{-2}$.

At time t = t seconds, Earth increases its spalocity from $0.12\ pdms^{-1}$ to $0.43\ pdms^{-1}$.

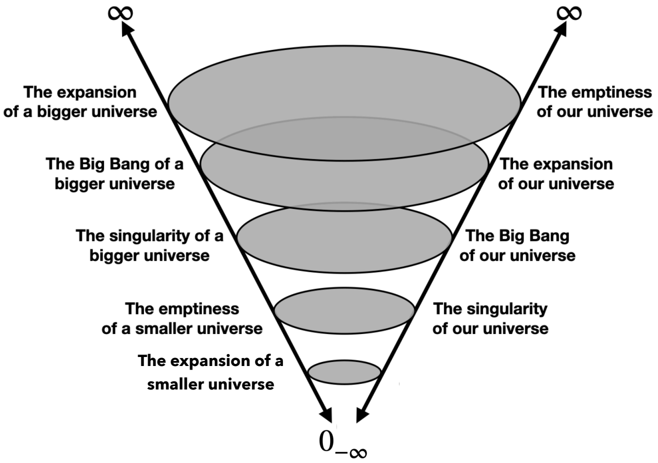
Earth therefore has a spaceleration of $0.31\ \ t^{-1}pdms^{-2}$.

At time t = t seconds we get the diagram of NGC 7513 and Earth on the following page.


+ Spaceleration ($pdms^{-2}$)
NGC 7513 Galaxy
7.732×10^{-15} $pdms^{-1}$
5.618×10^{-15} t^{-1} $pdms^{-2}$
Earth
0.43 $pdms^{-1}$
0.31 t^{-1} $pdms^{-2}$
+ Spaceleration ($pdms^{-2}$)

In the next chapter, we will explore the nature of singularities, what happened before the Big Bang, relative zeroes, the fate of the universe, expansional force and gravitational thrust.

3 — Dark Energy, Gravitational Thrust and Before The Big Bang


∞
∞
The expansion of a bigger universe
The emptiness of our universe
The Big Bang of a bigger universe
The expansion of our universe
The singularity of a bigger universe
The Big Bang of our universe
The emptiness of a smaller universe
The singularity of our universe
The expansion of a smaller universe
$0_{-\infty}$

What we refer to as 'The Big Bang' is not an event in the traditional sense, but an expansionary state of the universe relative to matter of our own size.

The universe as a whole is a continuum with no universal beginning or universal end. Rather, the universe has a beginning, duration and end relative to the matter in question, based on the proportion of the universe that matter makes up.

The beginning of the universe we experience is only relative to us — the expansion of the universe accelerates at a faster rate relative to us than it accelerates relative to significant proportions of the universe, and accelerates slower relative to us than relative to proportions of the universe significantly smaller than our selves. In the diagram above, ∞ (infinity) and $0_{-\infty}$ (absolute zero) represent two unreachable quantities; ∞ representing the never-ending, and $0_{-\infty}$ representing the never-beginning.

As we saw in the relative displacement chapter, the relative distances between planets and moons are shorter to planets and moons than to us, and the relative distance between a planet and a galaxy is shorter relative to the galaxy than to the planet.

For instance, we found that the distance between the Earth and the Moon of $384.4{\times}10^6$ metres was a relative distance of approximately 30.27 pdm for the Earth and 110.59 pdm for the moon, whereas the same distance corresponded to a relative distance of $226{\times}10^6$ pdm for the human.

We found later in that chapter that the displacement of 60 million lightyears between our Earth and the NGC 7513 galaxy (5.6×10^{23} metres) corresponded to a relative distance of 4.41×10^{16} pdm for Earth.

For the NGC 7513 galaxy, the same distance of 60 million lightyears corresponded to a relative distance of only 789.29 pdm.

This showed that what appeared to be long distances in space to us were not long distances to celestial bodies such as our Earth or the Moon.

And what appeared to be an astronomical distance for our Earth was not an astronomical distance for a faraway galaxy such as NGC 7513.

If we were ‘in the shoes’ of something as astronomically large as a galaxy, the universe we would experience would be a proportionally less expanded universe than the universe proportional to our own size.

Equally, if one were ‘in the shoes’ of something significantly smaller than our selves, the universe would be proportionally even more expanded than for humans.

To astronomically small matter such as our selves, the universe appears to be astronomically large and is measured to have begun expanding approximately 13.8 billion years ago from a hot, dense singularity.

However, to significantly larger matter such as galaxy filaments, our universe is spatially much smaller than the universe we experience because there is proportionally less space for these structures to move in than there is for us.

The accelerating expansion of the universe they would experience is therefore proportionally slower than the accelerating expansion of the universe we experience.

As we showed in the second chapter, the spaceleration of a galaxy such as NGC 7513 from Earth was measured to be smaller than the Earth's spaceleration from NGC 7513.

Because of their size, the motion of galaxies and galaxy filaments is significantly slower proportionally to them than to us.

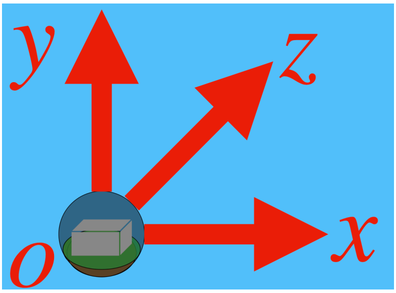
To significant proportions of the universe, the universe has hardly expanded at all.

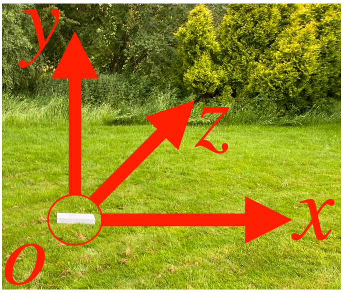
Thus, the beginning of the universe which we experience precedes the beginning of a larger universe that significant proportions of the universe experience, because the expansion of all space between all matter in the universe is larger relative to us than it is to them.

What would be the singularity of the universe relative to colossal galaxy filaments is larger than the singularity of the universe relative to what we experience. Equally, what would be the singularity of the universe relative to matter of our size would be an expanded universe to smaller matter.

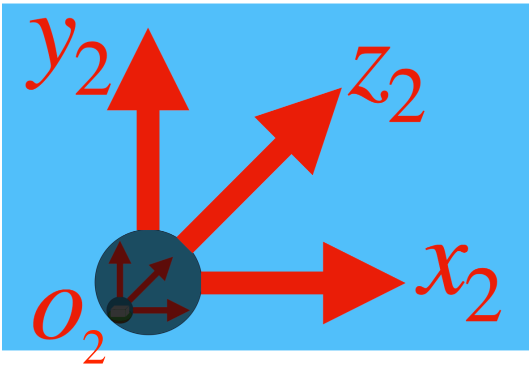
In the first chapter for instance, we showed that anything, irrespective of how large it may be, can fit inside of a zero-dimensional point relative to a larger space.

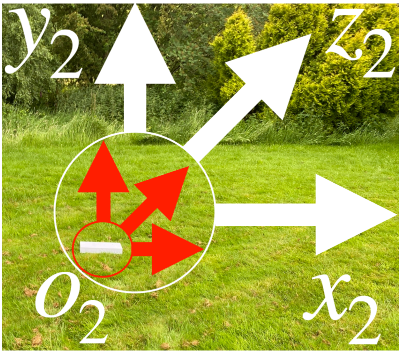
Anything, no matter how large, is confined inside of a relatively zero-dimensional point or dimensionless singularity proportional to its own size, in which further axes (dimensions) can extend out of. Any expanded state of the universe is a dimensionless singularity state to a larger space and any singularity state of the universe is an infinitely-dimensional expanded state to a smaller space. A box on the ground and all of its dimensions were demonstrated as contained within an origin point in which the dimensions of the space outside of the box x, y, z extended out of. Relative to the box, there are higher dimensions (more space), but relative to the higher dimensions, the box is a dimensionless singularity (no space).

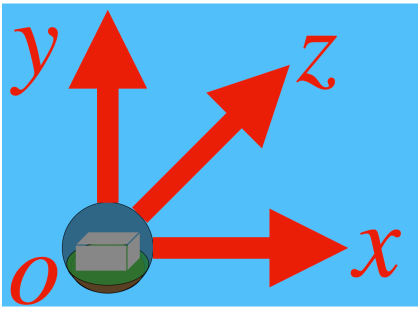


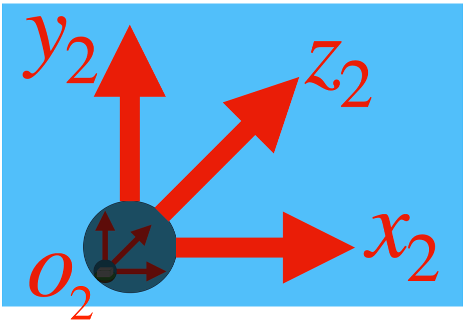


We then saw that the dimensions outside of the box, x, y, z, also existed within a larger zero-dimensional point in which further dimensions x_2, y_2, z_2 extended out of.









This brings me onto what I refer to as 'relative zeroes.' In the top left image, the box and all of its dimensions are at zero relative the dimensions outside of the box (x, y and z) as the box is inside the origin point relative to those dimensions.

In the top right image, the box and the dimensions of the space outside of it (x, y and z) are at zero relative to the dimensions of the space outside of that space (x_2, y_2 and z_2). One can therefore see that what is space outside of a particular body is all zero relative to an even larger space.

And what is dimensionless space relative to larger matter is dimension-more space to smaller matter. So there is no ultimate dimensionless singularity or ultimate zero for all matter, only a relative one. I refer to relative singularities such as O or O_2 as 'relative zeroes.'

At the start of this chapter, I stated that the beginning of the universe we experience is only relative to us. I then stated that the beginning of the universe which we experience precedes the beginning of the universe that significant proportions of the universe experience.

Therefore, what would be the origin or singularity of the universe relative to us is smaller than the origin or singularity of the universe relative to astronomically larger matter.

'Point zero' for us is smaller than 'point zero' for the astronomically large. And 'point zero' for us is larger than 'point zero' for the astronomically small.

Therefore, from the perspective of matter astronomically smaller than ourselves, the universe has expanded more relative to them than it has to us. The Big Bang from their perspective precedes our Big Bang.

When our universe (the universe proportional to matter of our own size) was still a singularity, the universe proportional to the quantum or astronomically small had already begun.

What may be small relative to certain matter is large to significantly smaller matter.

And what may be small relative to certain matter is non-existent to larger matter.

So there is no universal singularity or expansionary point, only lots of relative singularities or expansions inside of each other.

What is zero relative to one size of matter is not zero relative to another.

Similarly, what is astronomical relative to small matter is not astronomical relative to astronomical matter.

I denote relative zeroes as 0_x where x is the subject matter.

0_x can be used to denote a singularity state of the universe relative to the matter x.

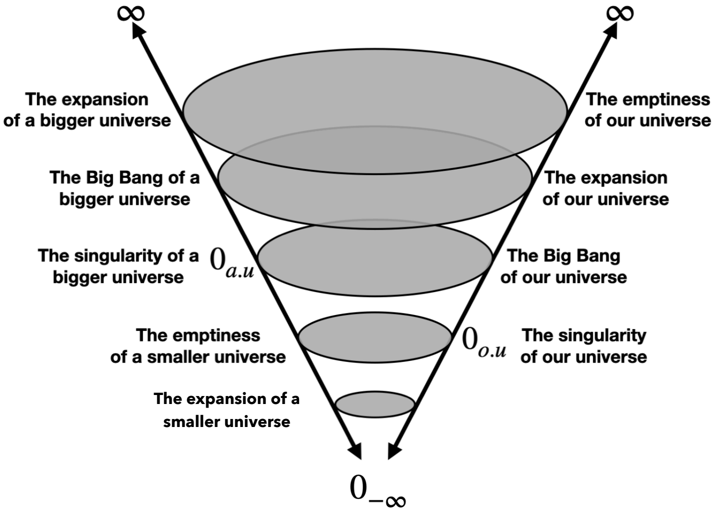
If we suppose that $0_{o.u}$ is the singularity state relative to 'our universe', that is the universe which matter of our size experiences and $0_{q.u}$ is zero relative to the 'quantum universe', that is the singularity state of the universe relative to what particles experience, it follows that

$$0_{o.u} \neq 0_{q.u} \text{ but } 0_{o.u} > 0_{q.u}.$$

If we suppose $0_{a.u}$ is the singularity state relative to what astronomically-sized matter experiences, where $a.u$ stands for 'astronomical universe', then it follows that:

$$0_{-\infty} < \ldots < 0_{q.u} < 0_{o.u} < 0_{a.u}$$

We can update The Big Bang Continuum graph to pinpoint the different singularity states of the universe relative to the size of the matter in question:


∞
∞
The expansion of a bigger universe
The emptiness of our universe
The Big Bang of a bigger universe
The expansion of our universe
The singularity of a bigger universe
$0_{a.u}$
The Big Bang of our universe
The emptiness of a smaller universe
$0_{o.u}$
The singularity of our universe
The expansion of a smaller universe
$0_{-\infty}$

To significantly larger matter than ourselves, the vast empty space in the universe which we experience is less vast. To significantly smaller matter, the vast, empty space in the universe which we experience would be gargantuan, empty space.

On page 60 we established the idea of the universe having an infinite beginning, that is a beginning which tends to zero but never reaches zero, denoted as $0_{-\infty}$.

So far, we do not know of anything to exist smaller than quarks, which brings me onto the concept of a ‘relative ending’ to the universe.

In the process of the universe expanding to make room for larger matter, it simultaneously disposes of smaller matter.

This is because as the universe expands, it continuously breaks up matter into smaller parts.

Once the matter is broken into smaller parts, those parts are then broken into even smaller parts. This continues to occur until the parts are so small that their sizes tend towards zero.

The sizes of smaller parts never reach absolute zero, but converge closely enough to zero that they may become undetectable. Imagine a piece of paper being continuously folded such that the paper is split along the crease of each fold. The paper would become continually taller and thinner after each fold until it appeared string-like. After an astronomical number of folds, the paper would not be visible at all.

As the paper was continually folded, it would never vanish completely, but would eventually become so thin that it would be non-existent relative to sufficiently large matter.

The universe expands for new matter to emerge. That matter is eventually pulled apart by the expansion of the universe to make room for newer matter to emerge. Another words, as the universe expands, the old makes room for the new and the new makes room for the newer.

Proportional to us, the universe is expanding into an empty universe. As the universe expands to become larger relative to larger matter, it becomes more empty relative to the smaller matter.

What is astronomical relative to small matter is not astronomical relative to sufficiently large matter. Similarly, what is zero relative to large matter is huge relative to small matter. Therefore, astronomical quantities are also relative.

I denote relative astronomical numbers as A_x where x is the subject matter.

Suppose that $A_{o.u}$ denotes an astronomically expanded state of the universe relative to us — that is, the universe in which matter of our size experiences, where $o.u$ stands for 'our universe.'

And suppose $A_{q.u}$ denotes the astronomically-expanded state of the universe relative to the 'quantum' — that is, the astronomically-expanded state of the universe relative to what particles experience.

Then it follows that $A_{o.u} \neq A_{q.u}$ but $A_{o.u} > A_{q.u}$.

If we let $A_{a.u}$ denote the astronomically expanded state of the universe relative to the 'astronomical' — that is, the astronomically-expanded state of the universe relative to what galaxies experience, for instance, then it follows that:

$$A_{q.u} < A_{o.u} < A_{a.u} < \dots < \infty$$

We now have the two inequalities:

$$0_{-\infty} < \dots < 0_{q.u} < 0_{o.u} < 0_{a.u}$$

and

$$A_{q.u} < A_{o.u} < A_{a.u} < \dots < \infty$$

Suppose the singularity state of a quantum universe, $0_{q.u}$, expands to become an astronomically large quantum universe, $A_{q.u}$. Suppose also that $A_{q.u}$ is large enough to form the singularity of our universe, $0_{o.u}$.

Therefore, it follows that $A_{q.u} = 0_{o.u}$

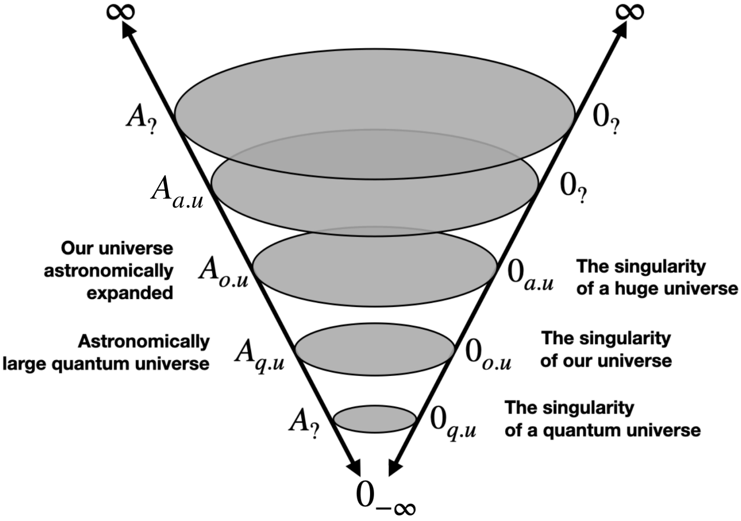
Now suppose our universe, $o.u$, expands to become an astronomically large universe relative to us, denoted $A_{o.u}$. Assume that $A_{o.u}$ is large enough to form the singularity of a hugely gargantuan universe, $0_{a.u}$.

Then it follows that $A_{o.u} = 0_{a.u}$.

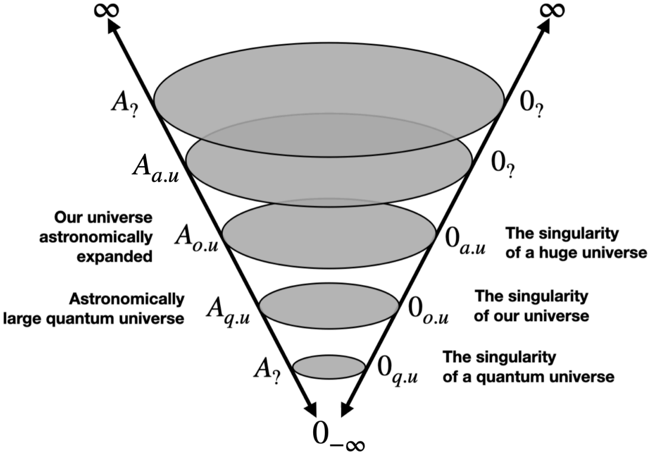
We therefore have the following inequality:

$$0_{-\infty} < \ldots < (A_? = 0_{q.u}) < (0_{o.u} = A_{q.u}) < (0_{a.u} = A_{o.u}) < (0_? = A_{a.u}) < \ldots < \infty$$

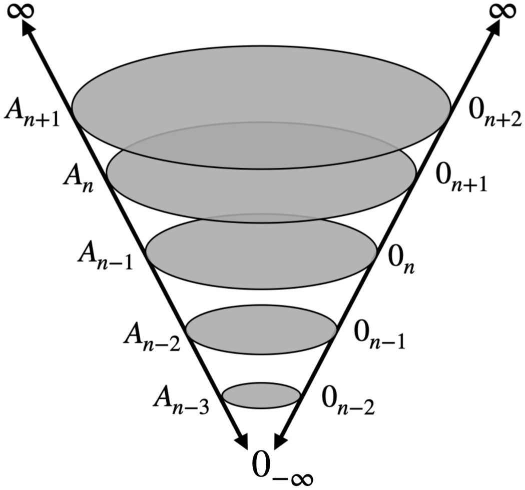
We can now update the Big Bang Continuum graph to illustrate this inequality as shown below:

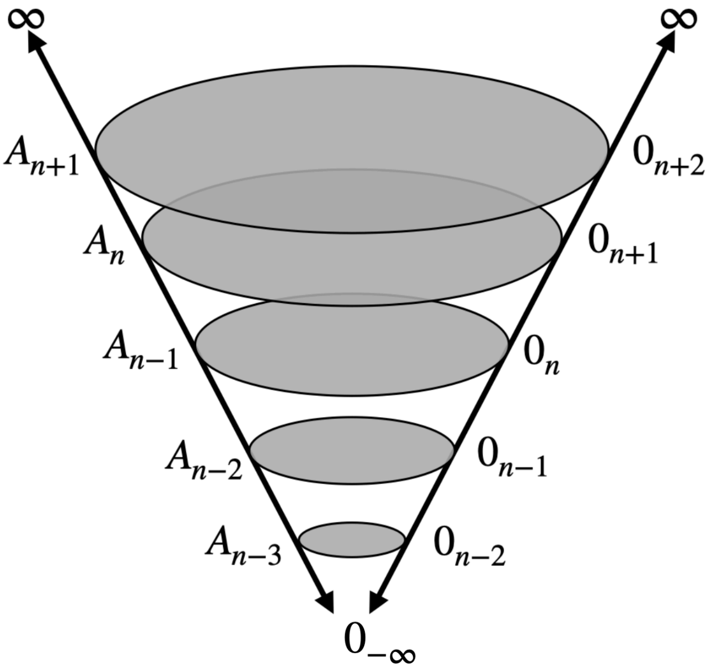

∞
∞
$A_?$
$0_?$
$A_{a.u}$
$0_?$
Our universe astronomically expanded
$A_{o.u}$
$0_{a.u}$
The singularity of a huge universe
Astronomically large quantum universe
$A_{q.u}$
$0_{o.u}$
The singularity of our universe
$A_?$
$0_{q.u}$
The singularity of a quantum universe
$0_{-\infty}$

The graph below illustrates the relationship between singularity and expansionary states of the universe.


∞
∞
$A_?$
$0_?$
$A_{a.u}$
$0_?$
Our universe astronomically expanded
$A_{o.u}$
$0_{a.u}$
The singularity of a huge universe
Astronomically large quantum universe
$A_{q.u}$
$0_{o.u}$
The singularity of our universe
$A_?$
$0_{q.u}$
The singularity of a quantum universe
$0_{-\infty}$

We can convert the graph above into an iterative scheme, where every disc in the graph is an iteration of the expansion of the universe. In the graph below, each 0_i represents a singularity state whereas each A_i represents an expanded state. For instance, the singularity of the *n*th universe, 0_n , is equal to an expanded (*n* - 1)th universe, A_{n-1} , and so on.





Let $0(u_n)$ denote the singularity state of a universe, u_n and $A(u_n)$ denote the expanded state of that universe.

The equation $0(u_n) = A(u_{n-1})$ states that the singularity state of a universe, u_n is an expanded smaller universe, u_{n-1} .

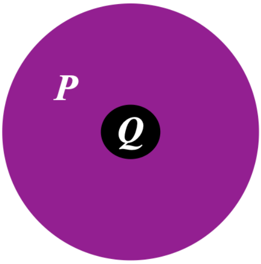
Equally, the equation $A(u_n) = 0(u_{n+1})$ states that an expanded universe, u_n , is the singularity of a larger universe, u_{n+1} .

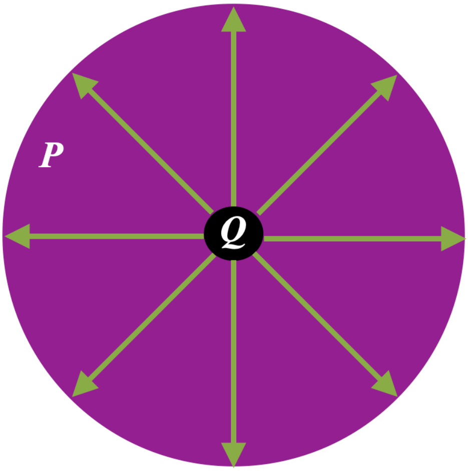
So far, we have established the concept of the universe as a synchrony of something (an expanded state) and nothing (a singularity state). A singularity state $0(u_{n+1})$ is always arising from an expanded state $A(u_n)$ and an expanded state $A(u_n)$, always arises from a singularity state $0(u_{n+1})$.

However, the universe does not merely **expand**.

If we suppose for instance that a space, ***P*** (purple) **expands** outside of another space, ***Q*** (black), then there is consequently a **force preventing** ***Q*** from **expanding** with ***P***. The first image shows ***Q***, a smaller space, inside of ***P***.

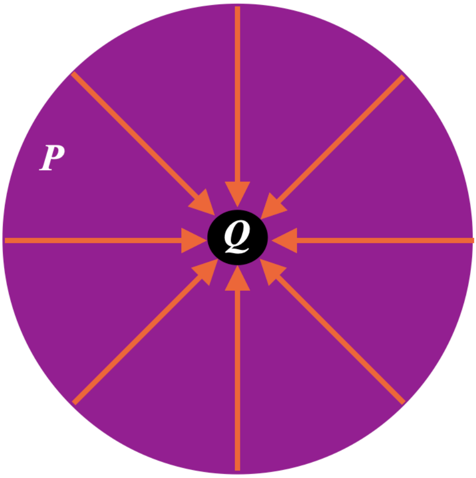
In the second image, ***P*** **expands** while ***Q*** **does not expand** with ***P*** and the **green arrows** indicate the **expansion** of ***P***.



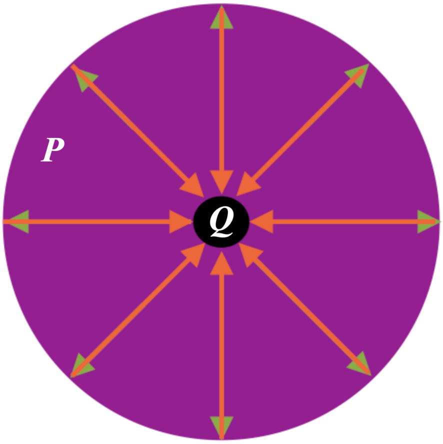


In the process of *P*’s **expansion**, it **creates force in the opposite direction** that **prevents** *Q* from **expanding** with *P*.

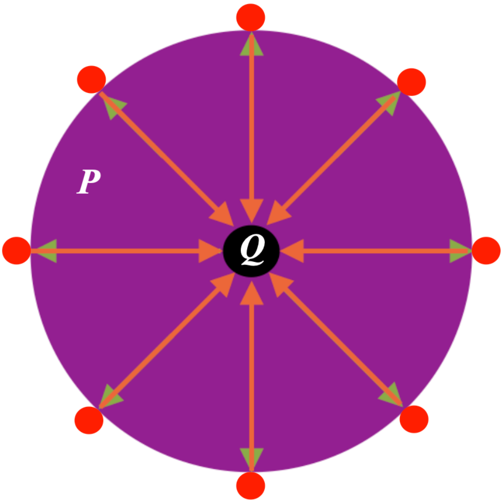
The **orange** arrows show *P* **applying force** on *Q* in the process of *P*’s **expansion**.



The green and orange arrows are not separate, but rather the same force from two different perspectives. The **green arrows** do not exist without the **orange arrows** and vice versa.



Now let us suppose there is a **distant galaxy** on each **green arrow**, (represented by a red point) and Q is the position of the observer. As P **expands**, the red galaxies move with P and Q **remains stationary relative** to P.



The expansion of *P* creates force in the opposite direction which moves the red galaxies further away from *Q*.

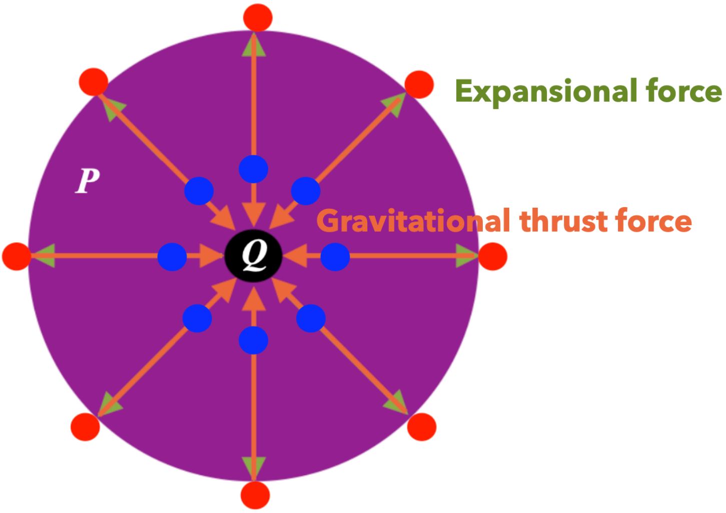
We suppose these red galaxies are so far away that when the observer at *Q* reviews the images captured by their telescope, they conclude that these galaxies are accelerating away from them.

Now let us suppose there are closer galaxies to *Q* , represented by blue points.

This time, the observer at *Q* concludes that these galaxies (blue points) are on an eventual collision course with *Q*.

The red galaxies that are on the border of *P* , follow the green arrows which take them further away from *Q*. Further towards the orange arrows, the expansion starts to weaken and galaxies instead gravitate towards *Q*.

The expansion of *P* behaves as an action force —- in order for *P* to expand, a reaction force must be applied in the opposite direction to the motion of the expansion. I refer to this force as 'gravitational thrust.' The gravitational thrust exerted by the red galaxies acts on these blue galaxies, sending them towards *Q*.

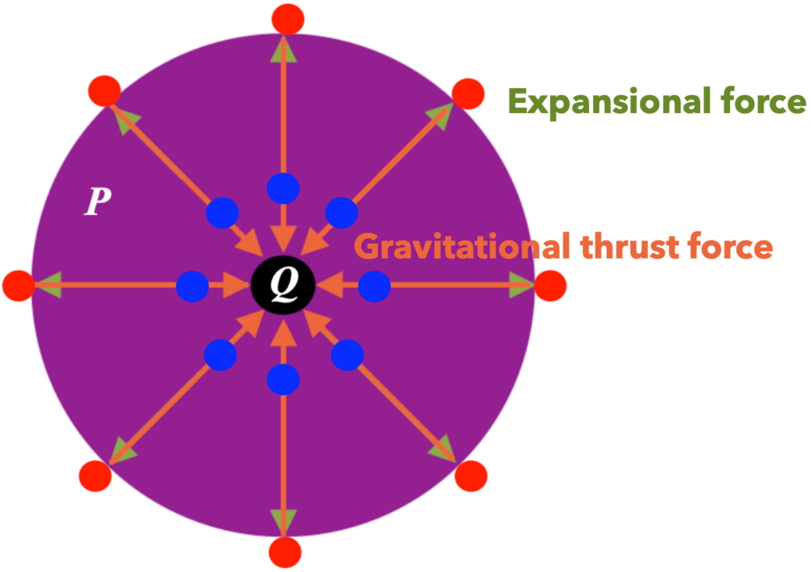


In the same fashion, the reaction force to the expansion of the universe is the force of gravitational thrust acting towards us.

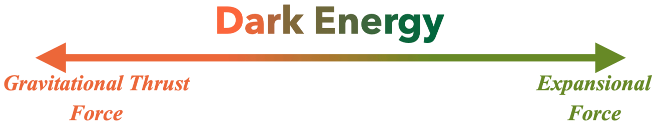
Gravitational thrust manifests as all of the gravitation which we observe and experience.

That is to say that the gravitational thrust force exerted by the expansion of the universe manifests as the gravitational pull of our Milky Way Galaxy and other nearby galaxies such as the Andromeda Galaxy.

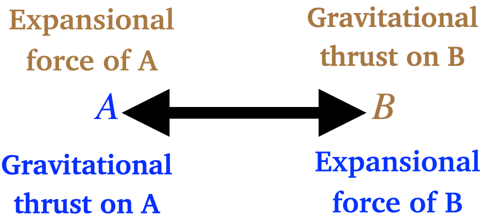
Our Milky Way Galaxy then has gravitational effects on our Solar System, and our Sun has gravitational effects on our Earth, which has gravitational effects on us.



Dark energy is one, synchronised force, which is *expansional force* in one direction and *gravitational thrust* in the other. The expansional force repels the gravitational thrust force and vice versa, highlighting the electromagnetic nature of Dark energy.

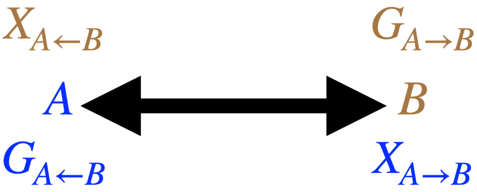


Given two celestial spaces A and B, the gravitational thrust force exerted by B on A's end is expansional force on B's end. And the gravitational thrust exerted on B's end by A is expansional force on A's end.



Let $G_{A\leftarrow B}$ denote the *gravitational thrust* exerted on A by B and $X_{A\leftarrow B}$ denote the *expansional force* of A from B.

Similarly $G_{A\rightarrow B}$ denotes the *gravitational thrust* exerted on B by A and $X_{A\rightarrow B}$ denotes the *expansional force* of B from A.



The gravitational thrust forces exerted on a celestial body are met with the expansional force of the celestial body itself.

The collective gravitational thrusts exerted on Earth manifest as the Earth's gravitational pull, which are in continuous clashes with the expansional force of the Earth. When all of these individual clashes reach their own respective standstills they form the curvature of hills, basins and all else.

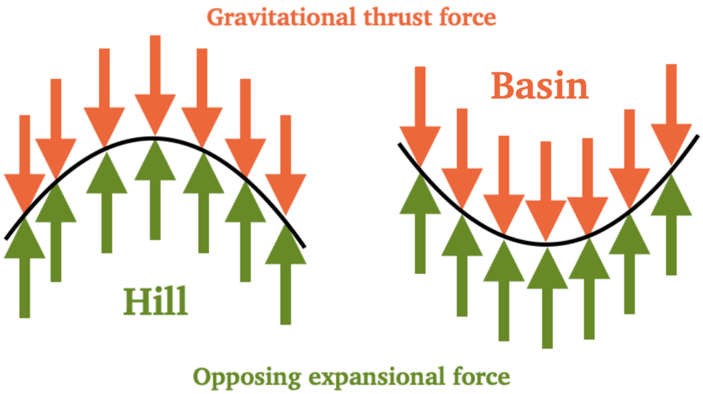
Higher standstills form the gradients of hills, fells, mountains or volcanos, whereas the lower standstills form dents, dips or basins in the surface of the Earth.

To small matter relative to the Earth such as ourselves, the distinction between hills and basins on the surface of Earth appears significant.

However, on the scale of Earth itself, the disparities between mountains and seemingly flat land are not as significant as from the perspective of our own size.

What appears as a smoother Earth from the International Space Station does not appear as smooth on the Earth itself.

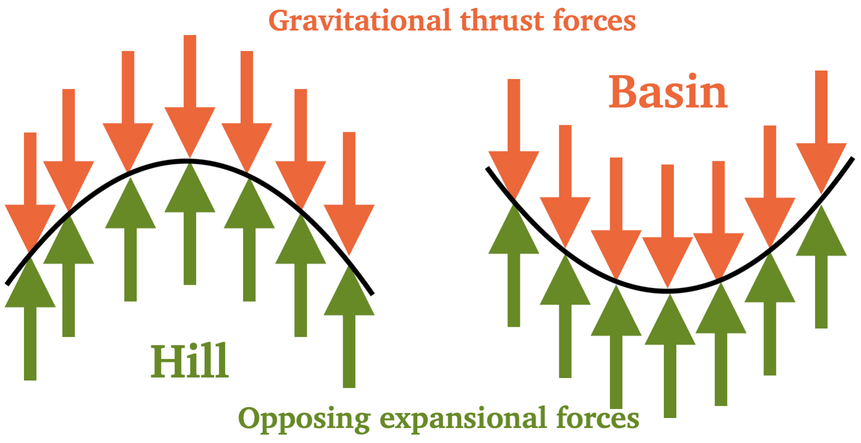
When we are on the Earth's ground, all of the slight imperfections in the Earth's curvature become immediately apparent.



As I mentioned on the previous page, equilibriums between gravitational thrusts and opposing expansional forces form the gradients of hills and basins.

For hills to exist, the points of expansional force along the curvature of hills must be in higher equilibriums with the gravitational thrust forces acting against them.

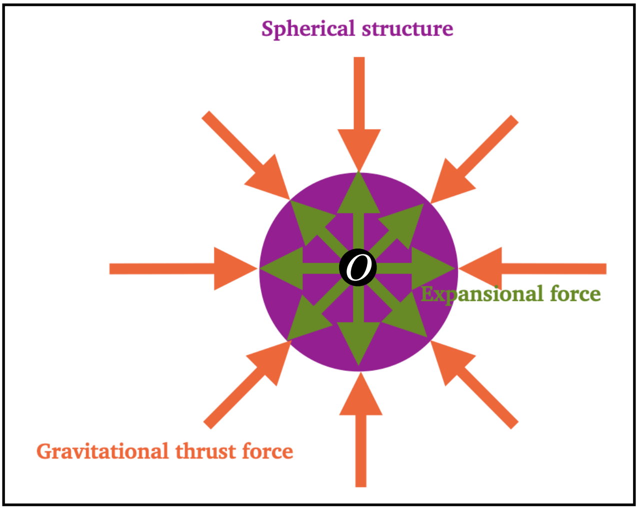
For basins to exist, the points of gravitational thrust acting along the curvature of the basin must be in lower equilibriums with the opposing expansional forces of the basin.

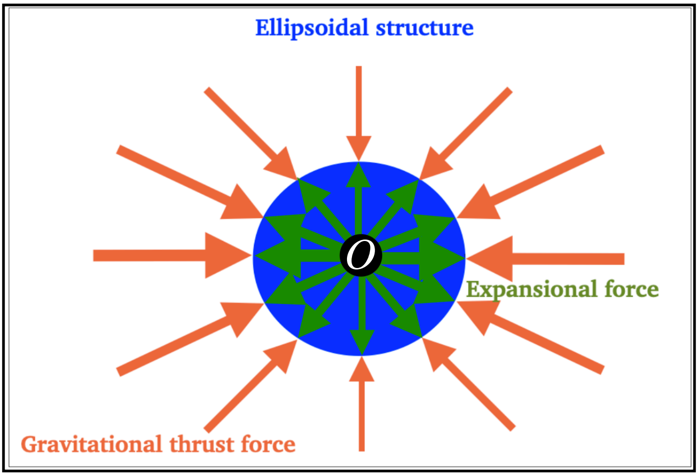


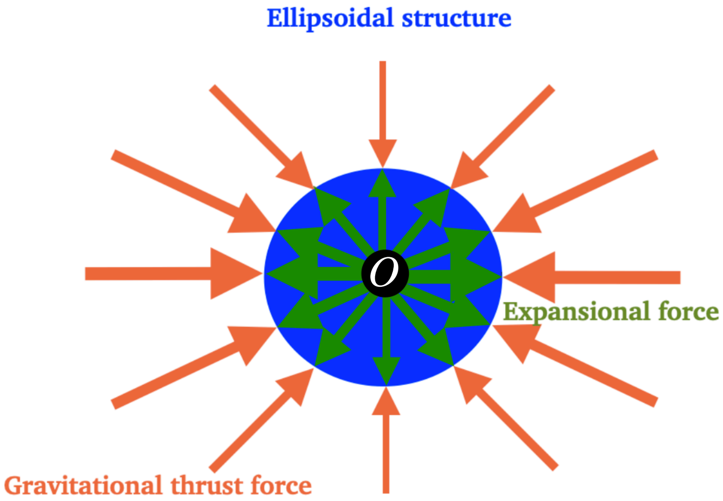
Gravitational thrust and expansional force on the ground do not merely manifest vertically — rather, they act in all dimensions of space. They can take the form of forces such as as friction, tension, air resistance, or even applied force such as walking or driving a car.

Any force of any matter which resists the forces of other matter is the expansional force of that particular matter. The expansional force of one body is a gravitational thrust force to another.

If a structure were perfectly spherical, the equilibriums of its own expansional forces and the opposing gravitational thrust forces acting on it would be the same across all dimensions of that body. In imperfectly spherical or ellipsoidal structures, the equilibriums between gravitational thrusts and the opposing expansional forces are not the same across the whole body.



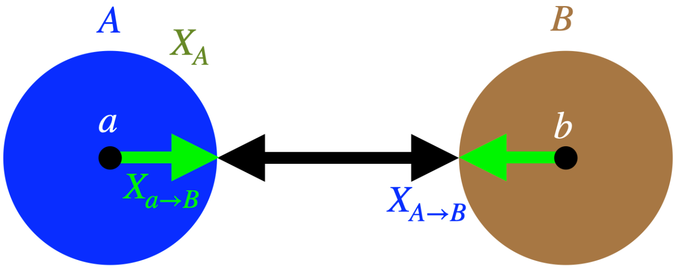




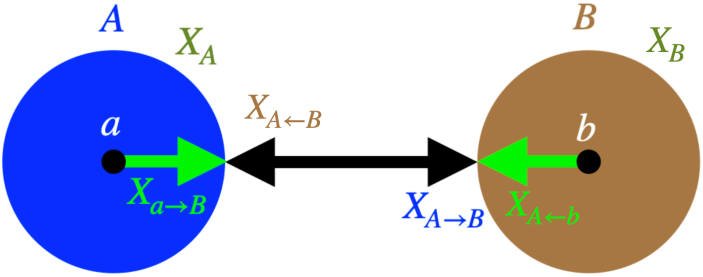
In spherical or ellipsoidal structures such as Earth, the gravitational thrusts exerted on a particular point, O, clash with the expansional forces extending out of the point O.

The equilibriums between the expansional forces of O and the gravitational thrust forces exerted on O form the spherical or ellipsoidal structure.

Returning to the earlier example of two celestial spaces A and B, let us now consider the expansional force of the inside of A towards B (i.e $X_{a\rightarrow B}$) and the expansional force of the inside of B towards A (i.e $X_{A\leftarrow b}$). The expansional force of the inside of A towards B, denoted $X_{a\rightarrow B}$, is one part of the total expansional force of the body of A (i.e X_A) such that $X_{a\rightarrow B} \in X_A$.



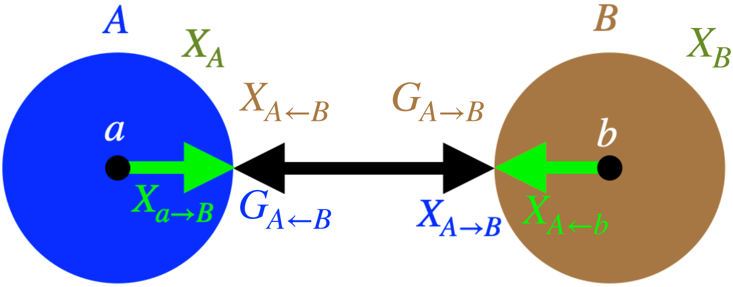
Similarly, the expansional force of the inside of B towards A is denoted $X_{A \leftarrow b}$. It is one part of the total expansional force of the body of B (i.e X_B) such that $X_{A \leftarrow b} \in X_B$.

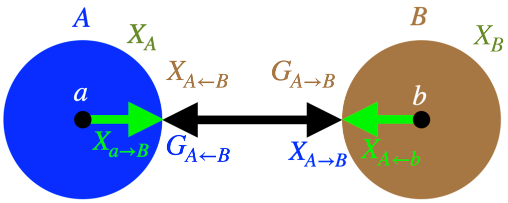


We have altogether considered A's expansional force away from B (i.e $X_{A \leftarrow B}$), as well as the internal expansional force of A towards B (i.e $X_{a \to B}$) . A's expansional force away from B (i.e $X_{A \leftarrow B}$) exerts gravitational thrust on B (i.e $G_{A \to B}$), and B's expansional force away from A (i.e $X_{A \to B}$) exerts gravitational thrust on A (i.e $G_{A \leftarrow B}$). Hopefully one can understand the difference between $X_{A \leftarrow B}$ and $X_{a \to B}$.

$X_{A \leftarrow B}$ moves the whole of A away from B, whereas $X_{a \to B}$ is the expansion of A's body towards B.

$X_{A \leftarrow B}$ and $X_{A \to B}$ are forces which move the whole of A and B away from each other, whereas $X_{a \to B}$ and $X_{A \leftarrow b}$ concern the expansion of the bodies of A and B themselves.





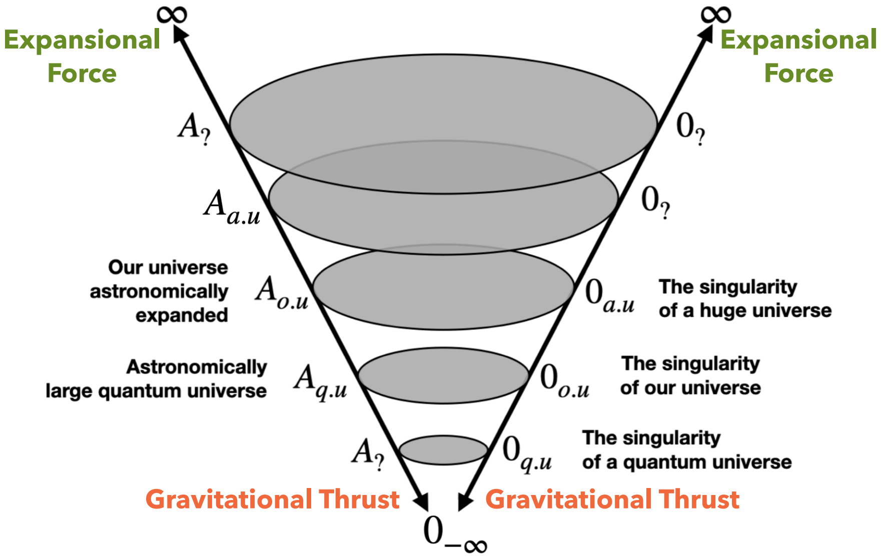
Even in nature, there are contexts in which gravitational thrust and expansional force manifest. Evolution, for instance, is a form of expansional force — species which do not evolve often cannot spread into newer environments. Furthermore, the extinction of one species may propel the evolution of another. In this sense, extinction is a gravitational thrust force.

In other cases, the evolution of a species may propel the evolution of another species or the extinction of a species may propel the extinction of another species. In the latter, the pushing force of one species towards extinction pushes the other species towards extinction. In the former, the pushing force of one species towards evolution pushes the other species towards evolution.

A species expanding into an environment may thrust other species out of that environment. A human-built settlement such as a city for instance, may push out other species or organisms which depended on the environment that was previously there.

In other instances, a human-built settlement may make favourable conditions for another species or protect one species from another species, promoting the expansion of that species. Therefore, the interdependent nature of expansional and gravitational thrust forces are not exclusive to the expansion of the universe, but are also emergent in nature.

On the The Big Bang Continuum graph below, we can now label the axes *expansional force* on one end and *gravitational thrust* on the other:


∞
Expansional Force
∞
Expansional Force
$A_?$
$0_?$
$A_{a.u}$
$0_?$
Our universe astronomically expanded
$A_{o.u}$
$0_{a.u}$
The singularity of a huge universe
Astronomically large quantum universe
$A_{q.u}$
$0_{o.u}$
The singularity of our universe
$A_?$
$0_{q.u}$
The singularity of a quantum universe
Gravitational Thrust
Gravitational Thrust
$0_{-\infty}$

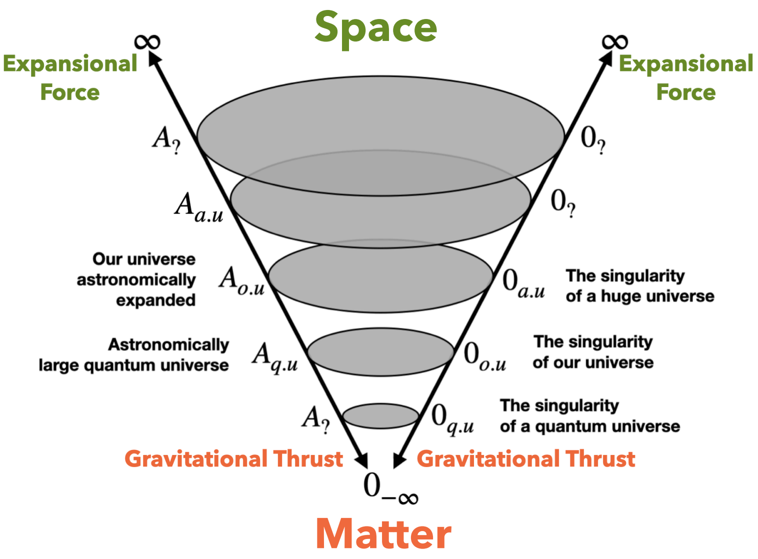
Expansional force divides up matter and creates space between matter. Therefore, expansional force tends to two separate axes rather than one axis.

Gravitational thrust, on the other hand, brings matter together and reduces space between matter. Therefore, gravitational thrust tends to one axis rather than two separate axes.

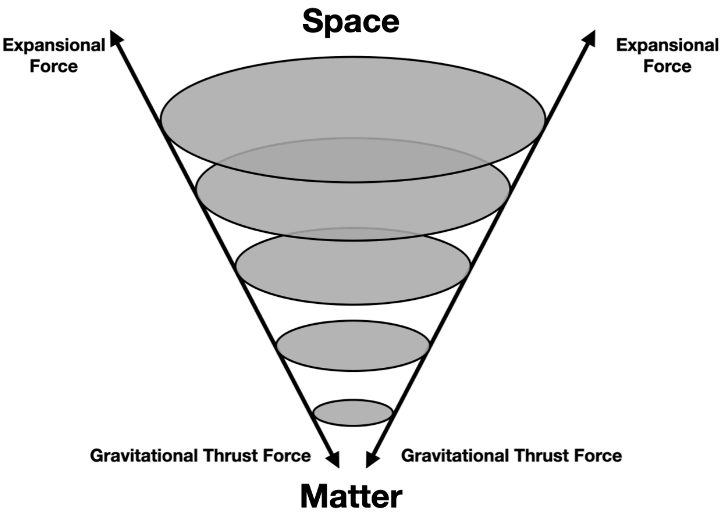
Expansional force concerns all expansions, fissions, divisions, repelling particles, replications, and reproductions.

Gravitational thrust on the other hand, concerns all gravitations, fusions, masses, attractions and collisions.

Expansion, or expansional force, is the force of space and gravity, or gravitational thrust, is the force of matter. And together, they form the inseparable relationship of space-matter.


Space
∞
∞
Expansional Force
Expansional Force
$A_?$
$0_?$
$A_{a.u}$
$0_?$
Our universe astronomically expanded
$A_{o.u}$
$0_{a.u}$
The singularity of a huge universe
Astronomically large quantum universe
$A_{q.u}$
$0_{o.u}$
The singularity of our universe
$A_?$
$0_{q.u}$
The singularity of a quantum universe
Gravitational Thrust
Gravitational Thrust
$0_{-\infty}$
Matter

Therefore, the general form of the graph is what I refer to as a 'space-matter graph.' It can be used to represent any instance of the two most fundamental properties of the universe: 'space' and 'matter' — where *expansional force*, the *force of space* and *gravitational thrust*, the *force of matter* exist in interdependent relationships that manifest as everything in the universe.



The space-matter graph below displays the two fundamental processes of **space** and **matter**: *space-to-matter* and *matter-to-space*.

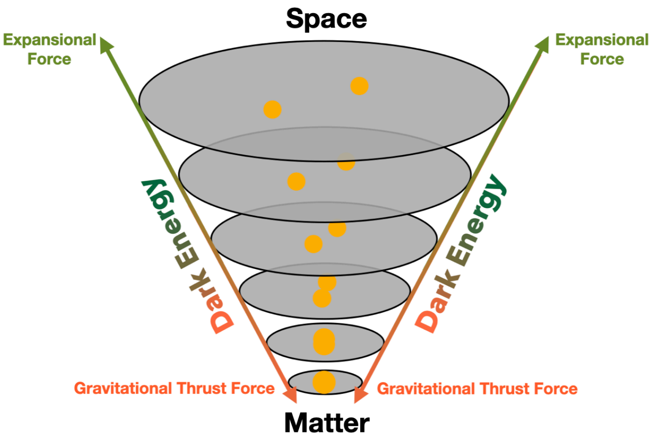
To observe the *space-to-matter* process, one looks up from the *matter* end of the graph to the *space* end. To observe the *matter-to-space* process, one looks down from the *space* end of the graph to the *matter* end.

In the **space-to-matter** process, two or more separate bodies gravitate to form one body due to gravitational thrust exerted on the bodies by an expansional force.

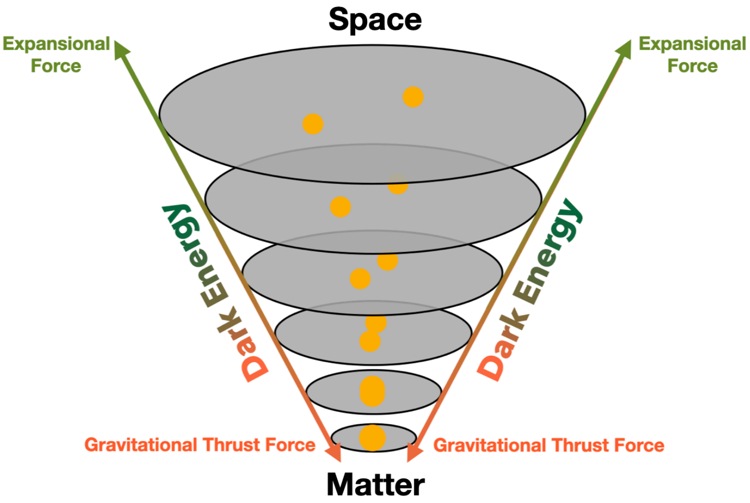
In the **matter-to-space** process, one body breaks or splits into two or more separate bodies due to expansional force exerted on the body by a gravitational thrust force.

Applications of **space-to-matter** include all gravitations, fusions, masses, attractions and collisions. For instance, chemical compounds, the gravitational pulls of celestial bodies, the singularities of black holes, nuclear fusion and attracted particles.

Applications of **matter-to-space** include all expansions, fissions, divisions, repelling particles, replications and reproductions. For instance, the expansion of the universe, nuclear fission, binary fission in microorganisms and repelled particles.



Conclusion



In summary, all space, matter and their interdependent relationships can be represented on a space-matter graph.

Dark energy is a double-arrowed force which is expansional force on one end and gravitational thrust on the other. When gravitational thrust acts on separate matter it brings them closer together, creating clusters or fusions. Expansional force can move matter further away from other matter, expand matter and split matter into separate matter.

In the first chapter, the concept of bodies, objects and spaces having spatial dimensions beyond three was first introduced. The concepts of singularities and expanded states were then briefly introduced on the principle that all bodies, objects and spaces can be contained inside of an origin point proportional to their own size. The chapter then explored the concept of dimensity and infinitely-dimensional spaces, establishing spheres as spaces with infinite dimensions.

It was then established that when a body, object or space is placed inside of a sphere, the infinite dimensions of the sphere must pass through that body, object or space, indicating that the body, object or space inside the sphere must also have infinite dimensions.

It was also shown that larger bodies, objects or spaces had higher quantities of infinite dimensions than smaller bodies, objects or spaces.

This principle was analogous to the concept of the set of rational numbers being larger than the set of integers given that both are infinite.

The concept of relative displacement was briefly introduced using the analogy of a chessboard with two differently-sized kings. What were three horizontal squares proportional to the white king was one horizontal square proportional to the black king.

In the second chapter, the formula for relative displacement was used to convert a universal measurement of displacement (eg: metres) into a measurement proportional to the size of the body in question.

Relative displacements for two different bodies of vastly different sizes (eg: a planet and a galaxy) were then compared to highlight the significant disparity.

By converting a measurement of displacement into a measurement proportional to the body in question, it enabled us to better understand how differently-sized objects or spaces experienced the same distance.

Two new forms of motion based on the concept of relative displacement were then introduced.

The second form of motion covered spaceleration, the change in one's spalocity over a time interval.

The individual spacelerations of the NGC 7513 galaxy and Earth were then compared to show the disparity in the accelerating expansion of the universe proportional to each body.

This introduced the concept of a relative universe in which the singularity and expanded state of the universe were different depending on one's size proportional to the universe.

The singularity state of the universe proportional to one size of matter is an expanded state of the universe proportional to a smaller size of matter.

Equally, an expanded state of the universe proportional to one size of matter is a singularity state of the universe proportional to a larger size of matter.

This established the concept of the universe not having a universal beginning or universal singularity state for all matter. The concept of relative zeroes was then introduced to represent the relative singularity states of the universe.

The life and death cycles of the universe were also explored, establishing the notion of the universe having a relative ending depending on the proportion of the universe the matter in question made up.

The singularity and expanded states of the universe were then expressed as an iterative scheme where an expanded state of the universe proportional to one size of matter was equal to a singularity state proportional to a marginally larger size of matter.

Dark energy was established as one, synchronised force, which is *expansional force* in one direction and *gravitational thrust* in the other. The expansional end of the force repels the gravitational end of the force and vice versa, highlighting the electromagnetic nature of dark energy.

Manifestations of expansional force and gravitational thrust were also explored, such as the formation of curvature.

Finally, the space-matter graph was introduced as a model for all interdependencies of space and matter, expansional force and gravitational thrust.

Thank you very much for reading my paper I hope you enjoyed reading it as much as I enjoyed writing it.

About the Author

India Soale holds a Bachelor of Science in Mathematics from the University of Sussex, where she graduated in 2023.

In 2019, as part of the first year of her degree, she completed a project on the Fourth Dimension, covering four-dimensional spaces and calculating the volumes of their spaces.

In the Summer of 2020 she became very interested in the Riemann Hypothesis and spent a great deal of time experimenting with different infinite sums.

In January of 2021, during the Coronavirus Pandemic lockdowns she began experimenting with L-functions. At the same time she also developed an interest in the P Versus NP problem.

She postponed her efforts to solve the Riemann Hypothesis, in order to concentrate on her Mathematics degree and the development of her iOS App “Peekner.”

During the Summer of 2022, after much thought about the true nature of dimensions, variables and parameters in relation to a space, she became interested in the P Versus NP Problem, and worked on devising an algorithm that would implement all the dimensions of a space. Her subsequent work on this problem resulted in her paper “P = NP Mathematically Explained.”

Following her attempt to solve the P versus NP problem, she completed the third year of her BSc in Mathematics.

During the summer of 2023, she began working on her *Theory of Infinite Dimensions*, which led to her *Theory of Relative Displacement*, and subsequently her *Theory of Gravitational Thrust*. Her work on these theories resulted in this paper.